THE FOUNDRY

VOL. 9. DETROIT, MICH., DEC., 1896. No. 52

The Founding of Statuary.

BY HORACE G. BELCHER.

There is something inspiring in a mass of metal wrought into the form of living beings. And if to this form is added such apparent action as to cause us to doubt its creation by man, we can readily see why such work commands attention. We admire a piece of machinery for its strength, we are awed by its power. We look at a large bell or other great casting and we are impressed with its mass. We turn our eyes towards a statue and power, mass and material is forsaken. We judge this kind of work by a different standard, and rate its greatness according to the amount of life the makers have been able to infuse in it. The great-

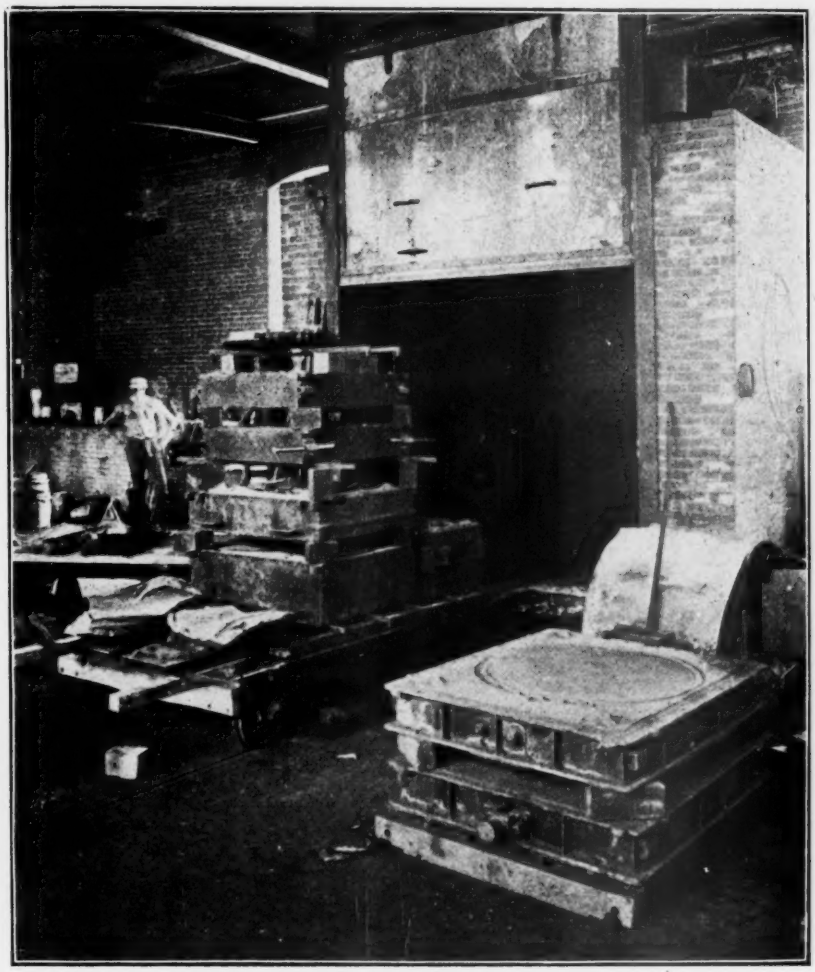


FIG. 1—VIEW OF CORE OVEN.

est statute is not the largest, but the one that is truest to life.

Bronze founding, as a fine art in this country, is at the commencement of a new era. The artistic sense and taste which fills the cities of the old world with masterpieces of the greatest sculptors and workers in imperishable bronze, has, here, until the last decade, been subordinated, and made secondary to the commercial spirit of trade, although many bronzes, of artistic merit and worth, prove the native ability. Of late years there has been a revival of this ancient art, which antedates the earliest written records of history, and increasing recognition of the value of American work. It is no longer necessary to send models to Europe for fine castings, as work equal to the best produced in the old world, is made here, in foundries established within comparatively few years.

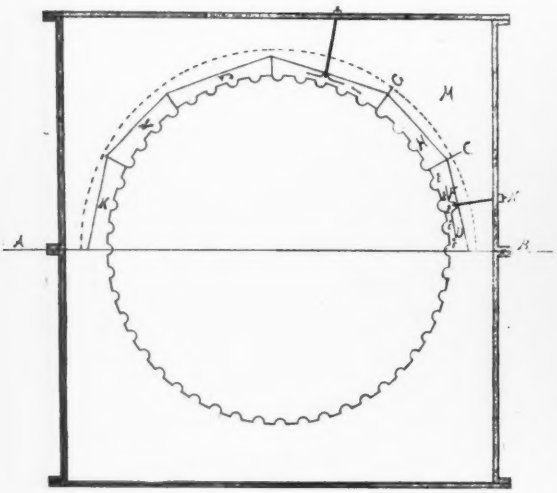


FIG. 2—HOW THE SECTIONS OR DRAWBACKS ARE FORMED.

Of these foundries, one of the most recent, as well as most notable, measuring by the standard of work executed there, is that of the Gorham Manufacturing Co., silversmiths, at Elmwood, a section of Providence, R. I. This foundry, opened nearly six years ago, is, like the silverware establishment of which it is a branch, probably the largest in this country, and is in many respects unique. Advanced methods are used there, and much of the apparatus is peculiar to this foundry, having been invented as needed.

THE FOUNDRY.

The foundry is a brick building 100 feet long, 40 feet wide and 25 feet high, with monitor roof, and stands apart from the main factory building, facing the east. The foundry is well lighted by double windows, in addition to the monitors in the roof running the entire length of the building. Artificial light is supplied by arc lights and incandescent lamps, and the building is heated by steam. The interior seems a confused mass of cranes, heating ovens, molding troughs, benches and flasks. Neatness is, however, a most prominent characteristic, and there is an entire absence of confusion, especially during the pouring of a statue, when the workmen never lift their voices above their ordinary tones. Every man knows his part in the work, and orders are rarely given, except by a wave of the hand.

FIG. 3—SCULPTOR'S ASSISTANT DRESSING PLASTER CAST.

THE FURNACES.

Molding troughs, small iron flasks, and other tools for making church plate, small bronze and brass ornamental work, fill the first 20 feet of the space at the left of the entrance. As this work is all fine, requiring facing and drying, the small oven (Fig. 1) is located here also. This oven is 20 feet

wide, 12 feet long and 9 feet high with an oven car for the larger pieces. It is of the ordinary design, heated from a coal fire, the larger oven being heated with oil. The remainder of the space on the left, against the side wall, is occupied by the melting furnaces. Of these furnaces there are 12 with a combined melting capacity of 3,960 pounds of metal although 4,000 pounds have been melted, and the crucibles could be forced to 4,500, but not without danger.

casting the skirt of the figure of Moses, forming the centerpiece of the beautiful King memorial fountain, at Albany, all 12 furnaces were used at the same time, the metal being concentrated in one large ladle, and the cast made successfully in 15 minutes from the opening of the furnace doors.

THE STATUE MOLDER.

The molders employed in statue founding represent the cream of the trade, since each

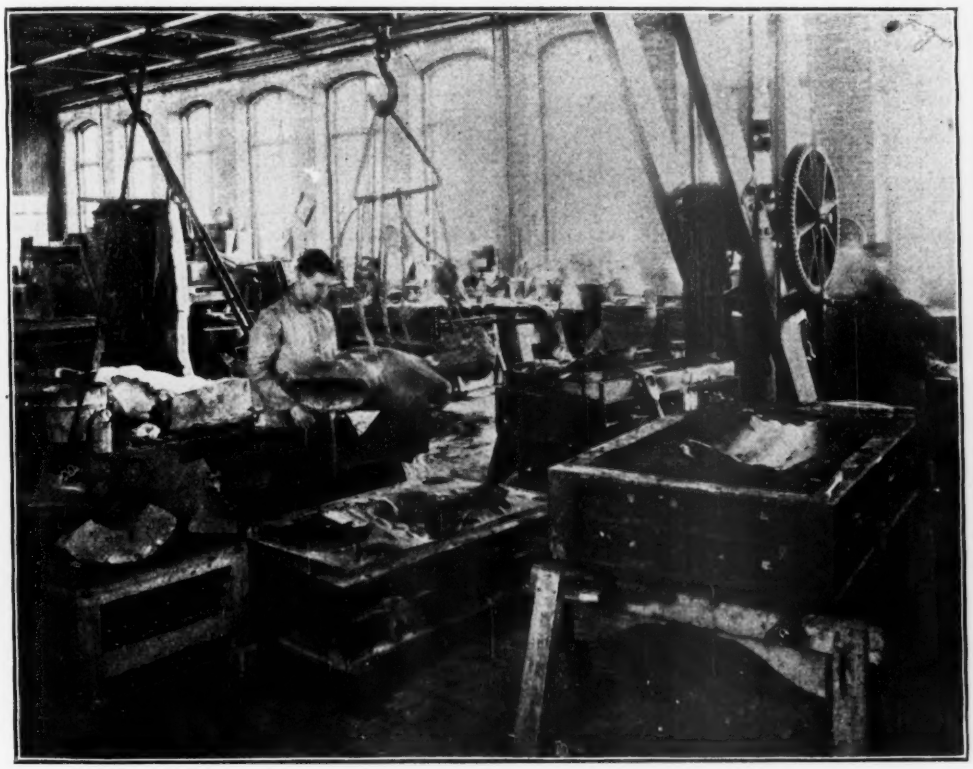


FIG. 4—A STATUE CORE.

Of these furnaces five hold No. 200 crucibles, with a total capacity of 2,500 pounds; two hold No. 100, capacity 600 pounds; two No. 80, capacity 500 pounds; two No. 60, capacity 300 pounds; while the twelfth holds a No. 20 crucible, capacity about 60 pounds. These furnaces are all run by natural draft, and pull into one smokestack. The crucibles are handled with two Yale & Towne chain blocks, fastened to carriages on two radial arms, one reaching the five large furnaces, the other the six smaller ones. In

must possess executive ability in a very large degree. There are but few molders who make a success in this line because it requires some inherent knack and an artistic touch that is seldom acquired. A man may be the best kind of a molder on the highest grade of ordinary foundry work, and yet be unable to grasp the situations that are here presented to him. What is true of the molder is also applicable to every other individual connected with such an establishment, and we state the case plainly when

we say that no other branch of the founder's art tends so much to bring out that quality, which we, for want of a better name, will designate as genius.

We all know of the difficulties that sometimes present themselves when locating a parting line in molding ordinary work. How much greater this must be where the mold has to be subdivided into a great number of divisions can only be appreciated when one meets the task. Then, too, the every-day molder has his coreboxes and his core-prints to guide him, whereas in statuary the entire absence of these tend to further perplex the peculiarities of the calling.

FIG. 5—ONE OF THE MOLDS AND SOME OF THE SECTIONS.

THE CORE OVEN.

At the rear of the building beside a small door is a forge, bench and vise, used by the molders in making core frames. Beside this is the large oven heated with oil burners. It is 14 feet wide, 18 feet long and 10 feet high, with a large sliding door counterbalanced, so as to move with little friction. The oven has two heavy four-wheeled cars, each 7 feet long, and 4 feet 6 inches wide. Wheels, car and bearings are perfectly true, the cars running on rails 35 feet in length, laid on solid masonry, thus avoiding all possibility of jarring or springing the molds. The most interesting feature of this oven is, however, the method of heating.

Instead of the ordinary coal furnaces in one or both corners, the oven has two fire chambers, heated by two four-gallon oil burners. These chambers, built of fire brick, are 12 inches wide and 8 feet long with a depth of 10 inches. They are covered with three-inch movable fire tiles, 14 inches square, a space of two inches being left between the tiles for the flame from the burners. There are two of these burners, one on each side of the oven, in the center of

the end of the fire chamber, each projecting about three inches into the furnace. They are of the ordinary brass pattern, each using four gallons of oil an hour. Air pipes on both sides of the oil pipe in the burner, spray the oil, which is fed the burners through pipes running below the floor. The valves are located just outside the furnace door, and the burners may be watched through a wicket in the door. This oven will dry a solid mold of French sand, four feet thick, in about 72 hours, while with coal 192 hours would be required, a difference of five days in favor of oil. Molds that take 168 hours to dry by the other method, have been taken out of this oven after 96 hours. There is no danger of burning the mold if the burners are properly watched.

This oven also has two coal furnaces, which may be managed from the outside, and an ash pit provided in case of possible defect in the oil burners. These coal furnaces are 36 inches long, 30 inches deep and 28 inches wide. The firing doors are 22x22 inches. The fire chambers and coal furnaces are all built of fire brick. The furnace roof is flat, girdered with small beams. Bricks laid without mortar are on the iron, with a covering of mortar and 14 inches of beach sand. It being an experiment at the time of building, difficulty was experienced with the oil heating, until its abandonment was decided on. Smoke came from the oil, covering the molds with a thick deposit, injurious to the flow of the metal, and preventing a sharp casting, even after the deposit had been brushed off. Experiments were continued, however, and the oil was sprayed more thoroughly against fire brick with fair success. It was noticed that the trouble was greatest after the main factories, from which the air pressure came, were shut down, and

FIG. 6—INTERIOR VIEW OF FOUNDRY.

this solved the problem. The uneven pressure from the air compressor was regulated and combustion is now perfect, without drawbacks. Oil burners have been used here for annealing with success, and also for melting. The heat generated is ample, 500 pounds of copper having been reduced in three-quarters of an hour.

Beyond the oven is the molding floor, covering 2,500 feet of the 4,000 feet floor space. On this floor are the two 10-ton Yale & Towne jib cranes, two cranes being thought better than a traveller. In front of one crane is a large statuary pit, 14 feet wide, 18 feet long and 8 feet deep, with brick walls in which spaces have been left for timbers covered with four-inch planking, making a solid working floor when the pit is not in use.

FIG. 7—FIRST APPEARANCE OF THE SILVER STATUE AFTER CASTING.

THE FLASKS.

The flasks or frames for the molds used in this foundry are of the extension form, unique, it is thought, in bronze foundries, although now universally used for the casting of steel. The old style box flasks have never been used here. The flasks are made in cast iron sections, each capable of being used as either end or side of any size, being lengthened or shortened by using the holes in the section. They are cast in channel form, with two trunnions on each piece, and in two sizes, 6 and 12 inches in width. All sections are alike, with ends drilled to allow their universal use, the holes coming always in the right place. With these sections a flask of any size may be built up easily and quickly. They are also compact, and the 90 odd sets of flasks of different sizes in use in the Gorham foundry, are stored in a space 16x30 feet.

We have devoted so much space to a somewhat detailed description of the foundry itself, partly because the work carried on here is out of the ordinary line, and also because we thought that the information here fur-

nished might be made useful elsewhere. We will now commence a description of the actual statue making, starting in with the forming of

THE PLASTER CAST.

It should be borne in mind that in statue molding, there is, like in all other branches of the trade, more than one way of doing

FIG. 8—ANOTHER VIEW OF THE COLUMBUS STATUE.

a given piece of work. Ingenuity has a limitless field here, which no narrator could completely cover.

The present practice, or rather the one most commonly employed, is to take the figure the sculptor has prepared in clay and make therefrom a similar figure in plaster. In this way the original model remains unharmed and is available should anything happen to the copy. To make a plaster cast and save the sculptor's work requires some molding, the only difference between making a mold to be filled with plaster and one to be filled with metal, being that in the latter the work is complicated by the core of the statue, while the former is cast solid and only requires an outside reproduction.

In order to make this operation as easy of understanding as possible the writer presents (Fig. 2) a section—not of a statue—but of a fluted column, in order to obtain an everyday object with which the average reader is familiar. Let us assume that a pattern of this kind is handed into the foundry without having any loose pieces, to facilitate molding, what would you do? Tell them it couldn't be done. That is what the average molder would say, but if everybody thought this way about it there would be no statues. Suppose now that the party owning this pattern should insist on you making a pattern for your own use, then the situation would be exactly what the statue molder faces in his regular work.

To duplicate this pattern in plaster of paris you would first be compelled to provide a mold for this purpose. Let us bed the pattern in and make a joint on the line A B. Finding that we can only draw back a certain part of the mold at a time we make a division on the line C, thus forming one section D. We make this section as long as we want to and fence it in with pieces of sheet iron well oiled or given a coat of soft soap to prevent the plaster from adhering. The pattern is treated the same way and we can then proceed in two ways, either making the section D of sand or plaster. If we choose the latter, we elevate the mold until that section occupies the upmost part, when we fill it with a mixture composed of two parts brick dust and one part plaster. If the section is of considerable length the rods E are inserted in the plaster and also the hook F, or a number of these according to the size of the section, the purpose of which will be explained later.

The piece of sheet iron we used to form the parting or boundary line at C is now removed to G, another part of the pattern is oiled and also the plaster joint at C to

prevent the next section of plaster, H, from sticking at this point. The same operation is repeated here and to the other sections shown, I, J, K.

We now have one-half of the pattern covered with sections of plaster, we put on the flask L and ram up the space M with sand. This we lift off and turn over. Each section of plaster is now removed from the pattern and fastened in its place in the cope with the hook F, as shown at N. The completed mold being thus withdrawn from the pattern without disturbing any of the numerous projections. A false cope is now put on and rammed up in the same position as the drawbacks and cope we just lifted off. In this way the joint line is exactly reproduced and after the other side has been formed exactly as the first half of the pattern, this may be withdrawn, which could not be done were there only two parts of a flask used.

The other half being treated the same way and the two parts bolted together we have a perfect mold of the pattern. This is now filled with plaster, giving us an exact reproduction of the original.

FIG. 9—THE COMPLETE STATUE.

The mold being removed from this in the same manner in which it was made, we can split this plaster model into a number of parts if this is thought to be more convenient. This is what the statue molder

does, an arm or any other projection being cast separate. We have shown this pattern divided on straight lines, but it will readily be seen that the irregular lines of statuary prohibit this. We have merely shown the division of a really plain job to avoid the confusion that broken lines would produce.

The plaster cast is, when deemed necessary, strengthened with iron, bent or twisted to suit the shape of the section, and embedded in the plaster. It is trued up in all places where defects are visible, Fig. 3 showing the sculptor's assistant at work chipping away the mold, removing from the figure its rough and clumsy coating. The figure, when cleared of the mold, is touched up when is reduced all over to the extent of the thickness desired. This way of obtaining the right amount of metal is so familiar to our molders as to need no description, they all know what is meant by shaving. But beneath all of this lays the securing, one of the most important subjects in all stages of molding. The peculiar shapes in which statues appear make this more difficult than in any other crooked job. Some idea of this may be gained from Fig. 4, where one of the cores peculiar to statues is shown hanging on the crane, affording a fair example of the work that is done without coreboxes and straightedges.

Fig. 5 shows one of the molds and a

FIG. 10—BRONZE SARCOPHAGUS.

necessary. The marks left by the seams are removed, and after drying the plaster cast is ready for the bronze foundry. While small statues are often cast in one piece, those of good size are usually made in sections which are assembled, fitted and bolted together, into one perfect piece.

MOLDING—THE SAND PROCESS.

As said before the molding of the casting itself differs but little from that of making the plaster cast as far as actual procedure is concerned. The model having been removed, with the aid of the complete half mold and the sections of the other half, the molder produces an exact reproduction of the model in whatever material the core is to be made from. This forms the core and number of the sections employed in the formation of same, conveying better than words an idea of the intricacies to be found.

MOLDING—THE WAX PROCESS.

We have so far only treated what is known as the sand process to distinguish it from the wax process. In the latter the mold is made from the plaster cast as before described. After the mold has become dry and hard its surface is well oiled and the required thickness of metal is laid on in wax by repeated coats applied with a brush. The mold is now ready for forming the core and a suitable core iron is placed therein, with pipes for carrying away the vent and the material of which the core is to be made is poured in. The plaster sections are carefully removed

and anchors inserted for holding the core in position. Running gates, vents and places for the molten wax to escape through are now made in wax, after which the mold may be finished the same as ordinary loam work. When completed the whole is placed in the oven to dry, where the wax melts away, leaving the core suspended by the anchors and a thickness of metal corresponding to that previously occupied by the wax. When the wax is all melted out and the mold and core thoroughly dry, the mold is ready to be cast after plugging up the holes left open at the bottom for the escape of the wax.

FOUNDING IN SILVER.

The best known casting ever made in this foundry, an interior view of which is shown at Fig. 6, was not of bronze, but of silver, the largest work ever undertaken in this precious metal. This was the statue of Columbus, modeled by Bartholdi, of Paris, celebrated for his statue of "Liberty Enlightening the World," erected in New York harbor. The work presented unusual difficulties and required great care from the value of the metal, and the fact that quantities of molten silver differ from those of molten bronze. The plaster cast was made by the sculptor in Paris, and the figure was cast in one section with the exception of the outstretched right arm. The metal used weighed 30,000 ounces, and for the first time in the world's history, men saw a figure of more than life size, cast in one of the precious metals.

Fig. 7 shows the first appearance of the Discoverer of America after the cope had been lifted off. Fig. 8 is the same statue when a further removal of debris had taken place, while Fig. 9 gives a view of the completed work.

The cooling of the casting was awaited anxiously, as the success of the experiment was in doubt. The figure proved perfect in every detail, and was one of the most striking exhibits in the Gorham department at the World's Columbian Exposition at Chicago in that year. The figure is slightly over six feet high and stands on a six-inch sterling silver pedestal. It is a masterpiece of vigorous art, and attracted much attention for artistic beauty. The statue has been reproduced in bronze for Columbus Square, in Elmwood, near the Gorham works.

Fig. 10 is a bronze sarcophagus, eight feet long, three feet wide and four feet high, weighing 3,500 pounds. That this kind of work is high art is manifest without any eulogy the writer could bestow.

Carbon in Iron.

By S. S. KNIGHT.

Considering the wonderful advance which has been made in science in the past twenty or twenty-five years, one cannot help but wonder at the slow progress or almost stagnation which has afflicted the chemical and scientific components of the iron industry, and which has been so great a factor in the absolute uncertainty of casting operations of to-day. By this I do not mean the modus operandi of the analytical process, but rather that for which the analysis is made, the knowledge of what elements should be a part of certain irons, which are intended for definite purposes, and in what combinations these elements should or should not exist. The grading of iron by fracture is an imbecility comparable only to the mixing of iron by the same method. Irons have many times come under the author's own observation about which absolutely nothing could be told by their appearance. For example, I have known a very close, strong iron to be graded foundry forge by fracture, when it contained nearly 4 per cent of silicon, and over 3 per cent of graphitic carbon. Its close, compact fracture was the result of the degree of heat at which it was run, and the amount of maganese and titanium that it contained. A pig with a cross section not to exceed 12 square inches could hardly be broken with a 30-pound sledge. Its strength was partly due to .12 per cent of titanium. The total combined carbon was .3 per cent. Hence the fallacy of grading upon fracture. If it be admitted that iron graded upon fracture is not graded correctly, then it must follow that every mixture made upon fracture is at best nothing more than a guess.

It seems to be accepted as an undisputed truth by the foundry men of the United States that only the elements need to be quantitatively known in order to give them full possession of the power to mix irons successfully. Analytical reports take into

consideration usually four of these—silicon, sulphur, phosphorous and manganese. It does not seem to be considered of any consequence as to how these elements exist, but simply how much of them. Only in carbon is distinction made, and then only as to free and combined carbon. It has been proved beyond a doubt that only these two determinations given under carbon, almost as little of the tenacity, shrinkage, and chill of the metal is known as if no determination had been made.

Of course graphite always makes an iron porous and open, and hence diminishes the shrinkage in proportions to the amount the metal contains; but how little titanic carbon will increase the hardness and also the tenacity of the metal? As previously stated, .12 per cent makes pig metal decidedly stronger. A question may be raised as to how this titanic carbon may be determined. The graphite determination of Brezelius always gives with the graphite the carbon that existed as titanic carbon. The method by Shimer with nitric acid gives the graphite only. Hence we have only to subtract the second amount from the first, as determined with hydrochloric acid, and we have the carbon which existed as titanic carbide. On the other hand, six-tenths of a per cent of carbon combined with iron or manganese would not perceptibly increase the hardness of iron.

The only explanation that I have ever read as to why iron should contain carbon was based upon the fact that all carbon is combined when the iron is melted in the cupola or furnace, and that it was thrown out in part in the form of graphite, as water throws out its impurities in part when it crystalizes.

In order to have crystalization of any kind, some time must be allowed for the molecules to arrange themselves. Quartz crystals can only be produced by allowing the silica to deposit slowly. So in iron, the slower the cooling the more crystaline the form. Now if graphitic carbon can only exist in iron that has crystalized, it remains but to cool the metal rapidly and all the carbon will necessarily remain combined. In order to test this, iron was taken from the cupola and poured through a riddle into icewater, thus allowing no chance for crystalization. The shot thus formed were disintegrated and analyzed, and free carbon found. The amount of combined carbon was slightly above what it was when allowed to cool slowly, but that was due to the interference with any possible reduction that might have occurred by such gases as carbon monoxide which escaped from the sand through the iron. Hence the theory that all carbon is combined in molten metal is wholly untenable.

The question as to whether it was possible to increase the amount of graphitic earbon in any iron has often been asked the author. The reason why this question is so predominate is undoubtedly because foundrymen have looked toward an excess of silicon and graphitic carbon as the Elysium of their hopes. The silicon had only to be put in, but the graphite—they did not know.

The old theory of carbon in molten iron faced them, and many that would have investigated gave hopelessly up when they found their ignorance was so common.

In fact, the whole question of definite result from definite causes in the mixture of iron seemed to be universally conceded beyond the limits of human understanding, and so the most of those who should have known when asked gave a wise smile and toss of the head, and replied that it took time to conquer such deep and abstruse subjects. They frankly admitted that they did not know, and those that even attempted an explanation were soon so befogged with their own inconsistencies that they gave up. All were too busy to investigate, and the few that did have theories had never put them to test.

Under these conditions a series of experiments were started. Results were closely observed and analyzed, and now it stands ready for verification by all who wish to prove to their own satisfaction that the only two requirements for the formation of graphite in iron are a low temperature of the molten metal and much carbon to flow over. The only thing that hinders hard iron from taking graphite is that too high a heat is required to melt it, and hence hard iron cannot be softened that way. The more silicon in iron the lower its melting point; hence the increase of silicon usually means increase of graphite carbon.

Such an hypothesis was taken since, when

iron is heated to scarcely above the melting point and carbon thrown in, graphite is produced—this being the method of manufacturing the graphite used in leadpencils. The result certainly most satisfactorily verified it.

In foundry practice, if it be desirable to increase the graphite, the iron should average 2 per cent of silicon at least, and should be melted high in the cupola, so as to have as much fuel to pass through as possible, and very little flux should be used—at no time over 40 pounds to the ton, unless the cupola is melting very fast.

Many suppose that the only difference between cast iron and steel is that in the former some of the iron is free, while in the latter it is all combined. While such is the case with the iron, still such is not the distinction between iron and steel. I know of no better distinction than that which Mr. Phillips makes, and which he states as follows:

"Iron has mixed with it certain impurities; steel is iron which has had its impurities diminished and combined with it."

Iron if heated to brilliant yellow in a cupola will have all its carbon combined; yet this is not steel. Such iron may analyze as follows:

Silicon, .381 per cent.

Phosphorus, .900 per cent.

Combined carbon, 3.52 per cent.

It will not crumble under the hammer and can be tempered extremely hard. In conclusion, it should be noted that of all the elements that enter into the constitution of commercial iron, no one element is so important and at the same time so little understood as carbon. Its influence only will be appreciated as foundrymen are alienated from the idea that iron mixing can be done without a thorough knowledge of the chemical as well as the mechanical uses and misuses of this element, and as its properties are known.

Influence of Heat on Cast Iron.

CORRECTION.

In publishing the above article in our November issue some glaring inconsistencies appear, to which we offer the following correction:

"From 3 to 1 per cent higher in silicon" should read "from .3 to 1 per cent higher, etc."

"Metal containing 25 per cent of silicon and 35 per cent of carbon 3 per cent of which was graphite" should be metal containing 2.5 per cent of silicon and 3.5 percent of carbon 3 per cent, etc."

"Still contained 2 degrees of silicon" should read "still contained 2 per cent, etc."

"One per cent of manganese will hold in combination nearly 5 per cent of carbon" should be "nearly .5 per cent of carbon."

"But with 2 per cent and 5 per cent respectively of phosphorus" should be "but with .2 per cent and .5 per cent, etc."

"Less than 2 per cent of silicon and 9 per cent of phosphorus" should be ".2 per cent of silicon and .9 per cent of, etc."

(We have impressed upon the junior philosopher, to whom we entrusted the proofreading of this matter, the importance that decimal points play in an article of this kind, and apologize to Mr. Knight for the annoyance that these errors may have caused him.—Ed.)

The Manufacture of Charcoal for Foundry Purposes.

By L. S. BROWN.

The subject from a scientific standpoint has had so much attention that anyone desiring to look into it will have no trouble in finding tables of great interest, although to a person with some knowledge of burning and without extensive learning, there may be a great wonder at some statements, and, no matter how learned the person, different authorities make conflicting statements; for instance, in one of the leading handbooks the subject is opened by saying: "A cubic foot of hard wood charcoal weighs 18.5 pounds, and a cubic foot of pine charcoal weighs 18 pounds." From personal observation it is my impression that the cubic foot of hard wood coal will weigh 14 pounds and of the pine 8 pounds. A large per cent of all charcoal used at the present time is produced by chemical concerns, who burn the wood in iron retorts for the purpose of making wood alcohol, actate of lime, etc.

These retorts are set very much as steam boilers are set, having a place under them to build a fire. They are made from cast iron,

quite heavy, almost as a large iron pipe would be closed at one end, excepting one pipe running from it at the rear, and door covering entire open end. The wood is placed in this retort, then the door is closed tightly, also cemented around the seams to make it as air-tight as possible. A fire of coal, wood or natural gas is lighted under it, and in a very short time smoke begins to come from it, and is allowed to pass out from the retort through an iron pipe at rear, and by having the pipe pass through water it changes the smoke to liquid, which is afterward distilled into wood alcohol, etc. After the smoke is all out of the wood the front of retort is taken off and the red charcoal raked into iron cans, holding about fifteen bushels. It is quickly covered and cemented with fire clay, making it air-tight. In twenty-four hours it

FIG. 1—NEARLY READY TO START THE FIRE.

is opened and spread on floor to be sure there is no fire left in it, and then it is ready for market. It is usually taken from the floor and loaded in box cars, nearly all works having a side track, making loading and handling at a very little cost.

This is called acid or chemical coal, and usually works equally as well as charcoal burned in kilns or pits. Whether coal be burned in a brick kiln or earth pit, the time and manner of burning makes a great difference in regard to weight of coal. The same kind of wood producing charcoal that varies in weight fully 20 per cent. The faster charcoal is burned the lighter the coal and the less coal produced from the same amount of wood. Many times the man who takes the longest time to burn is the one who produces the cheapest coal.

Illustration No. 1 shows the wood stacked and burner in the act of covering, after it is all covered except about two feet on top some dry chips, etc., are lighted on the wood at the opening left uncovered, which after a time lights the wood under it, when it is covered over with sod, leaving only a small vent hole on top and a larger opening made at lower side of pit. This being the only draft, the fire goes towards it, and when the fire gets to lower side of pit the vent on top is closed and one opened on the opposite side to the one first made on lower side. This draws the fire back to the center, and causes what is known as the sink, which really means the wood has burned up, allowing the surface to sink down. This takes about forty-eight hours. Then by making vent holes first around the top in a circle, about six feet from the center, gradually making them lower down as fast as the fire reaches the vents, which can be told by the color of the smoke, it can be drawn all through the pit. As fast as the vent holes are reached by the fire they are closed.

From the time the fire is first started, as fast as the wood burns away and settles down, the earth must be pressed down tight. This is done by stamping it down by the feet. If attended to every two hours there is no danger, although some have lost their lives by leaving the pits a long time and allowing the fire to burn up so much wood that when they came to stamp it down it would break through and precipitate them into the glowing furnace. As fast as coal is burned the pile settles down, and when it is nearly finished there is but little smoke, finally showing only a very clear light-colored smoke, when the vent holes are to be closed, and it is left two days to cool,making about twelve days burning and cooling.

Illustration No. 2 represents same pit after being burned and cooled with the coal being drawn. With a large iron rake the burner rakes out from the lower edge of pit the coal that is cool enough to remove, making a ring of charcoal all around the pit. The fine dirt from the covering rattles through, and after

the coal is raked off from it, it is thrown back on to the pit to keep it air-tight. If any pieces should show fire, which will certainly be the case if too much is taken off the outside at a time, it must have fine dirt thrown over it, which will extinguish it without the use of water. After the coal has been out of the pit a few hours it is ready to load for market. This is usually done after dark, as the fire is much easier to see and it is then ready to be taken up the next day. Where it is to be used for grinding into facing, the sooner it is ground the better, as it absorbs gases and moisture very rapidly.

Illustration No. 3.—It is the usual custom to make a tent-shaped hut of birches, and then cover over with sod for the burner to stay in while at work on the pit. With a small wood stove to cook on and warm the hut and straw and leaves to lie on the burner is quite comfortable, although he must go on to the pit every two hours.

Any change in the wind requires a change of vent holes, and as fast as it shows any signs of sinking down the covering must be stamped down over it. Sometimes when a pit is not watched carefully it caves in, making a big hole, and fire gets started very strong and burns it all to ashes.

In this method of burning it is very satisfactory if three cords of wood produce one hundred bushels of coal.

Illustration No. 4 shows a different method of pit burning. The wood is piled higher, and instead of being covered with sod it is first covered with boughs or twigs of trees, or with leaves, if to be found, and then earth put on top. In piling the wood an arch is left from one side to the center of pile, so that instead of lighting on top it is lighted at center of bottom of pit. When it has burned up through the center, which takes from twelve to eighteen hours, the top is closed almost tight and vent holes made in a circle around in top. The illustration shows the burner making the first row. As the fire reaches these they are closed up and others made lower down, until fire has been drawn through entire pit. The wood shown in foreground is to feed or dress the pit, and this is the principal difference in the two methods. Every few hours the pit is opened and more wood put in, which does not allow it to sink down. All through the burning wherever it shows any sink, it is opened and wood put in. After the fire has been drawn to the lower edge of pit and has burned sufficiently, which is known by the color of the smoke, same as in the other method, the vent holes are all closed and the pit is said to be burned down ready to cool up. It is left in this condition about twenty-four hours; then the dirt is scraped off from the leaves, a small section being taken at a time, the leaves are raked out clean, the fine dirt being thrown back over the coal, making a pit exactly same shape as at the beginning, only not as large, while first pit spoken of is very irregular in shape, as nothing is done only to keep it pressed down. It is left in

FIG. 2—DRAWING THE COAL.

this way from twenty-four to forty-eight hours, and then drawn same as in first illustration. By feeding or dressing the pit, it keeps it burning much longer and slower, taking nearly double the number of days to burn; but it is more economical, as for 100 bushels of coal it uses but two and one-quarter to two and one-half cords of wood. It also makes a superior quality of coal for all burning purposes, as it contains more heat.

There are several kinds of brick kilns, both square and round.

Illustration No. 5 shows a brick kiln, known as a bee-hive kiln, which makes a very high grade charcoal of smaller size than from any of the other style of kiln. For common use the coal is preferred to any other kind of kiln coal, it not being as coarse, but is not considered quite equal to best pit or

earth-covered coal. The wood—about forty cords—is packed in as solid as possible, at first being carried in through a large door, on the opposite side to the one shown, but

FIG. 3—THE BURNER'S HOME.

level with the ground. After it is filled as high as the top of the door, it is then carried to the upper door shown in the illustration. When it is filled both these doors are closed and cemented and a vent hole opened on top of kiln. Then, through a little arch left from an opening in lower door to center of kiln, the fire is started, usually by using a pole with rags on end saturated with kerosene, dry wood with chips and shavings having been placed in center of kiln. After it burns up through from the center to the top, the top vent and also draft hole in lower door are closed up and vent holes around the side opened by taking out bricks. At first thick heavy smoke comes out, but when it is burned sufficiently the smoke is almost colorless. These vents are then closed and others lower down opened. After it has burned all through, all the vent holes are cemented tight, and a coat of whitewash is applied over the entire pit to make it as air-tight as possible. It is then left for four days, when it may be opened and taken out. While in earth pits the fire never goes entirely out, a kiln can be stopped so air-tight that after four days there are no signs of fire, and can be drawn at leisure. By this process one cord of wood usually makes fifty bushels of coal.

The lower temperature at which pit charcoal is produced, or the slower it is burned the greater amount of moisture will it absorb. Therefore for use in foundries, for facing or parting, it is very important that the proper wood be used, and equally important that it be properly burned. When it is first exposed to the air, it is absolutely free from moisture; but in twenty-four hours it will absorb from 4 to 8 per cent moisture, and in a few days will have absorbed about 12 per cent moisture from the air and will take no more unless wet. Many times it absorbs moisture so rapidly that condensing it in its pores generates so much heat that it is set on fire. This often occurs while it is in the ring, as in illustration No. 2, or after it is loaded on wagon and is commonly attributed to the fire not being entirely extinguished in all the pieces. It occurred after the coal was drawn from pit last mentioned (illustration No. 4).

The first of the coal was raked out and pit covered up again about 12 o'clock midnight. As no fire was seen for next two hours, the burner went into his hut for a little nap and

FIG. 4—ANOTHER METHOD OF BURNING.

slept too soundly. At daylight he found ashes where there was charcoal; 400 bushels had been burned up. As most burners are

hard working men, without too much learning, it is hard for them to believe this, but all authorities admit it. Many times coal burned especially for foundry facing is burned down ready to ring out at a time when it is raining, and so has to be kept in the pit for several days. This is very dangerous, as it is impossible to close a pit close enough to extinguish the fire, and it sometimes runs through the entire pit again, spoiling it for heavy facing or for facing to be mixed as a wash. It also injures it greatly for burning purposes, as it contains but little heat, no matter what wood it was burned from. For some purposes, however, it adds to its value, and for a very light facing, for parting in brass foundries and similar work, also to be granulated for filtering purposes, it is greatly improved. In fact, it should be burned this way. For filtering purposes it is entirely tasteless, and will absorb a much larger per cent of gases, and after being used until thoroughly filled can be placed in a closed vessel and heated red hot, which will expel the gases and make it as valuable as when first granulated. This operation can be repeated several times.

While if pulverized or granulated charcoal is placed in a crucible and covered, it can be heated to almost any degree of heat without changing it so as to be perceptible, a very little thing can destroy it for many purposes. The writer, who has had an extensive connection with the charcoal industry, wants to record an incident to prove this. In August, 1894, a large storehouse was burned, and, our mill being located in the country, there was but little water supply. We had in one section about 300 barrels of stove plate charcoal. As the barrels on top burned away it allowed the fine coal to fall down over the barrels underneath, so that in cleaning up we found about twenty barrels without the slightest appearance of having gone through a fire, and as the coal covering them was perfectly dry we could not see how in any way they could be injured. Having removed the coal carefully from on top of them, those on the extreme bottom were not even soiled. We could see no reason for supposing they were not all right, and in order to keep our customers supplied until we could get more we sent a few barrels on each order, and not one barrel gave satisfaction. We mention this to show how sensitive charcoal is.

In closing this subject I would suggest that many could find much benefit by looking into it carefully. In the first place, there are many large iron foundries that are obliged to pay excessive prices for wood to kindle the cupolas with, where it would be to their advantage to use charcoal. Very close buyers, who have looked into the matter carefully, have decided that charcoal is cheaper than wood wherever the cost is not more than two and one-half times as great as wood. Another advantage of its use for this purpose is that you get no smoke and the expense of handling is less, as less than one-third in bulk will do the work. Many brass foundries complain of the fine coal received in each load, not appreciating that if a little pains is taken to screen out the fine coal that money can be saved, as a load with the fine measures but a little more than it would if it was taken out, and for covering the pots while melting it will certainly save much of the metal that, where the pots are not covered, burns away and is lost. In fact, I have customers who want the finest coal they can get and who never think of leaving a pot of metal exposed to the air a single minute.

FIG. 5—BEEHIVE KILN.

In 1543 the manufacture of iron in England became a permanent item of industry through the efforts of Ralph Page and Peter Baude.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

Published Monthly by

"The Foundry Publishing Co."

DETROIT, MICH.

JOHN A. PENTON,

EDITOR AND PROPRIETOR.

DETROIT, DEC., 1896.

Entered at the Post Office at Detroit, Mich., as second-class matter.

SUBSCRIPTION—One Dollar per year in advance to all parts of the United States and Canada; one dollar and fifty cents per year to all parts of the Universal Postal Union. May be sent by express, draft, money order, registered letter or U. S. postage stamps. Single copies, 15c.

CLUB RATES—Eight or more subscriptions sent at one time, 75 cents per year each. Cash to accompany order.

Advertising rates furnished upon application

SUBSCRIBERS can have address changed as often as desired

IF YOU FAIL to receive your paper promptly, please notify us.

THE FOUNDRY is issued promptly on the 20th. of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

The Detroit News Company,

Publishers' Agents, Detroit, Mich.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, N. Y.
The Buffalo News Company, Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohoi.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver Colorado.
The Detroit News Company, Detroit, Mich.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New Orleans News Company, New Orleans, La.
The New England News Company, Boston, Mass.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburg News Company, Pittsburg, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Company, San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Company, Toronto, Ontario, Canada.
The Washigton News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburg News Company, Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

Trade Outlook.

Without a particle of justification and in the most inexplainable manner the foundry business (we do not refer to any other) seems to be trying to be just as wretched as it can. We very much doubt if it was ever any worse than it is now.

At this particular season, of course, a universal slacking up is looked for. In anticipation of stock taking and the close of the business year, the great majority of concerns anticipate a slacking up along about this time, but that does not commence to account for the universal depression.

There is, however, in this instance one very encouraging feature that has not to our knowledge before existed when business was poor and that is the easy condition of the money market and the positive assurance that deserving enterprises can rely on a certain amount of support.

It is the first time in several years that the present degree of confidence has existed in financial circles, and this is likely to sooner or later transmit a good influence all along the line.

When that buying movement does set in, it is likely to be of a very substantial character, and if nothing unusual happens some prosperity may be looked for.

One discouraging feature is of course the possibility of congressional tinkering with tariff or financial matters, but it is not at all likely that any widespread distrust is likely to be aroused by anything that may be attempted in that line in the near future.

On the whole, the outlook is quite full of promise, while the present is full of universal stagnation, and THE FOUNDRY believes that 1897 will see inaugurated a long period of prosperity.

Scrap Heap.

The newspapers are commonly given the credit of being the greatest educators of the American people. Outside of the legitimate range of news they place before us from time to time articles on subjects so varied as to entitle them to the name of cyclopedias.

In so far as the matter they present is correct and so long as it truthfully describes actual conditions the value of it should not be underestimated, for it is then truly educational. It is when it transcends from the

beaten path of facts and leads the reader in the wrong direction that the newspaper creates a wrong impression, difficult to eradicate later.

* * *

It ought to be a well established fact to the man of average intelligence that no one can write of something with which he is unacquainted. It is essential for one to be familiar with the subject he treats before he can transfer to others a full knowledge of the principles involved. To one acquainted with the contents of the average newspaper, the absence of a regard for the truth becomes at times painfully apparent. Not that there is any doubt of the writer's sincerity, but the appearance of misstatements stamps the article as having been raised outside of its legitimate zone.

* * *

An article may be well written and still be worthless, it may sound all right to those who are ignorant of actual practice and be all wrong. Some of the best treatises on mechanical matters come out in very ill chosen words, their value laying in the kernel they contain. No amount of the poorest English can compensate for a man's lack of knowledge on the subject he chooses to discuss.

* * *

Read all the newspapers you want to, they are of great help to all of us, but don't forget in your eagerness to know something of things in general, to find out something about your own business in particular. When you come to do this bear in mind to consult the paper that is authoritative, "Your Trade Paper." It makes it a business to collect for illustration the best of current practice and nothing else. No paper has the facilities or the ability to give instruction pertaining to your business like your trade paper. The grammar may not always be the best, but it is substantial just the same, and when you are through reading it you know more than you did before. It is the paper that can tell you more about your business than any other, the paper that will give you an education you will use every day, the paper that will furnish you with bread and butter—your trade paper.

The Export of American Pig Iron.

Some comment has been excited by the increasing exportation of pig iron from the United States, and not a few have taken the ground that this was done at a loss to the exporters. One of the leading southern iron furnaces advances a more reasonable account of this situation when it says that the present exportation feature of the market is due first to the low price of iron prevailing in this country, and second to the exceptionally cheap charters by which ocean freight charges have been reduced to the minimum. Thus two distinctive features have combined to bring about the present condition.

The same authority notes that there is one gratifying proof in this connection; it is, that the price of iron cannot fall below a certain figure here without obtaining relief elsewhere. The price of raw material, ore and coke is so cheap here, that even with a higher rate of wages an outside market could still be had by ordinary freight rates. While it is stated that the profits on these transactions have been small, the result has been more far reaching than the actual gain involved, as it has tended to relieve the glutted condition of the pig iron market.

Why Improvements are Slow in Coming.

The Iron Trade Review answers editorially a question asked in "Locomotive Engineering," as to why the foundry is the last place to receive the benefit of improved appliances. In doing so it takes the ground that the hostility of the molders has been one of the principal causes to hinder the introduction of new appliances.

We are on this point compelled to differ with our worthy contemporary. It is true that opposition has been manifested by workers in all trades against any innovations threatening to take away their present chance to earn a livelihood, but it is also true that such opposition has never been allowed to prevail nor been able to sustain itself against the condemnation of public opinion. Every improvement that has been made in any line of industry has carried with it opposition, because it became necessary for its successful working to either displace individuals altogether or else reduce their number; they have been compelled to find other avenues of employment, and this has at all

times produced some friction. But every improvement is soulless and pushes itself to the front just as far as its merits will allow, and if foundry improvements have not been able to secure introduction such is not caused by the molders' hostility but by a lack of merit or a failure to show merit.

What molder objects to the power crane that deprives him of the chance to strain his back? Who finds fault with the sand conveyor or the trolley track system that ease the burden of manual labor? Did you ever find a molder who refused to pour a casting with the geared ladle? Did a case ever come to your notice where the molders refused to accept a better illumination because it would allow them to do more work?

A leading manufacturer of molding machinery recently mentioned that the old cry about molders' hostility was becoming antiquated and should be buried along with the campaign lies of the season. The officials of the molders' union have never expressed any hostile views on the introduction of machinery and improved appliances—nor have any others possessed of sufficient intelligence to be considered good citizens.

The large number of molding machines in actual use testifies that the molders' hostility has not amounted to anything. The number of machines that have been installed and taken out again, have been discarded, not because any effective boycott had been placed on them, but because they lacked the quality, so essential to all improvements, that of being money-makers.

Prospectus.

THE FOUNDRY has in the past bestowed especial care upon its Christmas number, and the present issue will not be found lacking in any of the good qualities that has characterized it since its appearance.

Christmas time is probably the only occasion throughout the year in which we relax our hold to a certain extent on the cares of everyday life and find time to look at our inner self. It marks another period during which we have discarded old ideas and methods and absorbed new ones.

As we progress so we develop wants. A desire is created within us for something that we have hitherto done without. THE FOUNDRY was made to fill such a want. Previous to its appearance foundry matters had received some consideration from a literary standpoint, but the publication of such was scattered among a dozen periodicals and appeared at uncertain intervals. Foundry literature was a side show and in more sense than one, for when you purchased a paper it was uncertain whether you would get your money's worth in foundry matter or something else.

With the advent of THE FOUNDRY all of this was changed. The foundry fraternity recognized that here was something the contents of which was known. In devoting itself to foundry interests without the admixture of anything else to increase its bulk it filled a want created by our progress.

The world's history to-day is not being made by the sword, but by industrial progress. The mechanic has supplanted the soldier. The artisan has become the builder of nations. The reverberance of the cannon's peal no longer heralds the growth of a commonwealth, in its stead industrial activity is the mightiest factor in its power.

The strength of a nation to-day lies in the ability of its members. A government is only the reflection of the individuals composing it. The man who handles a trowel is doing as much to perpetuate its glory as the statesman who frames its laws. The man who works in sand is as much of a support in the national bulwark as the one who works in marble or in any other calling.

Our relative position in society is a constantly changing one. We are more or less the builders of our own fortunes. The answer of successful men as to how they attained their ends is invariably that they worked for it. Whether you attain success with the chisel, brush, pen or trowel depends upon your own exertion. To those who realize that individual advancement must go hand in hand with individual merit, built up by a constantly increasing education, to those who feel that self-help is the greatest creation of ability, to those who want to make of themselves better mechanics and better men THE FOUNDRY stands ready during the coming year to furnish the powerful aid of practical experience obtained by the most brilliant men in the trade.

Krank's Korner.

Thinking is accelerated by being confronted with facts. The man who mistook lime for plaster of paris passed through a period of deep thought before he found out why the mixture refused to become solid.

* * *

Leaky blast pipes and air chambers are only a form of waste, entailing extra cost. A tinner can make a better joint, that will last longer, than the cupola tender can with a lump of clay.

* * *

Keep your feeding heads covered with a good supply of charcoal. This will not only add length of life to the metal, but is also a very effective remedy to prevent the metal from adhering to the feeding rod, one of the greatest obstacles in the way of long feeding.

* * *

A clean, bright chaplet, free from dirt and rust, is a better protection against blowholes than all the red lead and other preparations that can be applied to same.

* * *

In common with other employers, some of our foundrymen have occasionally rebelled against, what they termed, the interference of labor organizations with their business. After the smoke of the battle cleared away, when the fruits of victory could be measured, it is doubtful if sufficient gain was obtained to pay the indemnity incurred.

* * *

The Krank has been near enough to a number of these contests to observe that organized labor is not the only "commodity" of its kind that makes demands. The very element it is sought to employ, on the supposition that it is incapable of promulgating demands or dictating any policy, is found to be ready with all the requests the occasion permits. Nor is this strange when we consider that demands are but the natural following of a condition favorable to their propagation, that they will appear, whether fair or unjust, whenever it is thought possible to enforce them, by individuals as well as by combinations presenting and seeking to attain the same object.

* * *

As far as dictating or interfering with the employers' affairs is concerned, those subject to individual demands would suffer the greatest annoyance, because individual judgment cannot be held in control like that of the majority of a combination, where due consideration will reject unreasonable requests.

* * *

What we have sought to impress upon the reader is that a demand is not a creation of organization, but of circumstances; not of a union of individuals, but of conditions, and that the removal of organization will not effect a cessation of demands so long as circumstances and conditions remain unchanged.

Pokey's Pointers.

"I came out here to have a little argument before business gets too booming," said the old man to Tom Bowers, as he turned his back towards the salamander and rubbed his hands.

"Good day, for that kind of work," remarked Tom.

"How is that?"

"Because it is cold."

"And what has that got to do with it?"

"Well, the end of most arguments conclude with somebody getting hot."

"Gee whiz, but it is hot around here," said the old man, as he found himself steaming.

"Let me ask you a question, while I think about it, what do you turn around for?"

"What do I turn around for; why, you blooming Scotchman, what do you suppose? I turned around to get warm in front."

"And that is a pointer for you."

"It is, is it? Not by a darned sight. You might as well say that pulling my cap down over my ears was a pointer."

"What are you turning around for now?" asked Tom.

"You seem to be after information, Tom, but I will confide to you, that I turned to get warm behind this time."

"There is the same pointer again."

"Since you say it is so, I suppose I must believe it," replied Pokey, as he gave a hard look at Jumbo, who came up to take the frost out of his rammer. "But I don't feel as that pointer is close enough to me to hurt. Anyhow, where is the point?"

"It is that these salamanders only warm a fellow on one side."

"That is so," said Pokey, as he turned around again, while he bestowed one of his profit and loss glances on the coremaker, who was trying to get a kettle of water to balance in the fire. "There seems to be considerable gas in here; something is choking me."

"You will get used to that; we have all had to get acclimated," suggested Tom.

"I think we will have to make some more salamanders right away, Tom. Don't the men kick on working in this kind of weather?"

"No, they have been brought up that way, and take time to warm themselves."

"But that costs money, Tom. That is one item that Widbur and me missed in figuring up our costs. I must remember that. About how long do you think it takes them to do that, Tom, on an average?"

"As near as I can judge, about an hour a day in weather like this," answered Tom.

"That is a dead loss, Tom. They might as well be home in bed, for that matter. They don't earn a thing, except when they are working, do you know that?"

"I know," nodded Tom.

"Get some more salamanders made at once, Tom. It seems to me that if they would move a little livelier they could keep their blood in circulation, without thawing out so blamed often. I just happened to think of something. More salamanders will mean more coke, more coke more money to pay out; it is a dead loss in both cases. I will be hanged if I know which is best, to let the men freeze to a certain degree or to burn more coke and let them freeze a little less. What do you think, Tom?"

"I believe it is horse and horse between coke and wasted time as long as we stick to the salamanders."

"And what else can we use in a place like this? If we put in steam heaters like we have in the machine shop, we only warm the shop around the edges, and that wouldn't be much better than it is now."

"I was thinking," began Tom, as Pokey made a quick move to get out of the way, caused by the coremaker's pot of water boiling over and covering him with steam and ashes, "that there was some other way to get around all of this. I can figure so far, and then figuring becomes engineering; but the way I reason this thing out is this: We take a certain amount of fuel, and convert the heat of it into steam and pass this through pipes. For this is claimed greater comfort and more economy than if this very same amount of fuel was burned in salamanders throughout the places heated by the steam. What I want to know is: If this is a good thing, why couldn't we take the fuel these salamanders are burning up and turn it into hot air?

"You have been away from home, Tom. Never knew a man yet to go poking around other shops but what he came back dissatisfied with his own."

"Those that can't see a good thing, don't amount to much," retorted Tom. "Do you know how it works?"

"Yes; you have a heater and a fan in one end of the shop. A pipe with branches passes from the blower overhead to the other end. The blower draws the cold air through the heater and delivers it wherever it is wanted. Any two-legged being could understand that."

"It is the only way to heat a shop thoroughly and have everything out of the way. There is nothing to interfere with the cranes," suggested Tom.

"I never could come out here without I got something to think about before I left. You are a nuisance, Tom."

"What I want you to think about is if it wouldn't be just as cheap to burn our coke in a heater as in a salamander. What heat we did get would be more evenly divided, and, by Jupiter, it would be purer."

CORRESPONDENCE.

Editor THE FOUNDRY:

I have been a constant and an interested reader of your valuable journal for the past two years, and I am pleased to say that I have profited by coming in direct contact with the best authorities on foundry management and foundry business in the world, and would say a man interested in the foundry, from the molder to the proprietor, will be equally benefited by the articles published in THE FOUNDRY. As for myself, I would not do without it.

I have not been in close contact with the shop itself but a short time, and, of course, do not wish what I want to say to be taken for absolute authority on the cupola, but as

a beginner that wants information on the subject.

Is it practical to run a large cupola for more than one heat without dumping it? I have been experimenting with ours for some time, and have had very good results with four or five heats without dropping.

This is how I proceed: I drain out all the iron and slag that will run out of her, then cut out the breast (by the way, this is the only thing that bothers me much), and pull down the coke to the front of the hole, wet her down on top, punch all the slag and cinder away from the tuyeres, put on usual bed or fill her up to 18 inches above the tuyeres. I wet her down again and proceed to fill up as usual (our charges are about 5,000 lbs.); then let her stand till next morning, and we put in the breast, and we are ready for the blast. We melt on an average about 125 tons in eight or nine hours, and get very good iron. We make castings from ⅜" to 1⅜" thick.

We also get a ratio off of about 9½ to 11. Our cupola is 72 inches inside diam. We carry a lining about 12" thick, and renew same every four or five months.

Now, all I have stated have been absolute facts.

I would be very much pleased to have some of the readers of THE FOUNDRY take this up and discuss it. I think it is worthy of some little attention. At least, I would like some information on the subject.

J. G. R.

A Practical Way of Making Molders.

Editor THE FOUNDRY:

I read with great interest in the proceedings of the Western and other foundry associations, and am especially taken up with the discussions on the apprenticeship question. The system we have been employing in our foundry, though not suited to a jobbing shop, is the best I have seen for stove plate and agricultural foundries, and has proven so satisfactory to all concerned that very few of our boys have failed to serve their time out. Our company have no written contract with the boys. They can quit when they like, and are subject to dismissal when their work or conduct proves unsatisfactory. We have but one set of prices. The foreman sets the prices, and tries, in giving out jobs, to avoid favoritism except to those who do, not the most, but the best work. The particular work pays better than the plain jobs. We try to advance our boys as fast as the size of the scrap heap will admit. As our company make a good part of their own machinery, there is a chance for the boy to get a whack at that class of work. Our boys work 305 days at 30 per cent discount off regular prices, another 305 days at 20 per cent off, and the remaining 305 days at 10 per cent to the company's credit. As we pay only for time at work, it takes about four years to get through. We have boys who make more money during their second year than some of the old molders. The reason is plain. The boy shows an aptitude for the business; the man ought never to have gone into a foundry.

As a general thing, we take our boys from the core room after they have served a year there. We want him to have a knowledge of what a core is for, as we are working on the principle that, as far as possible, it is safest to make the delicate part of the mold on the core bench.

This article is not written to endeavor to show how good molders can be made, for the writer recognizes the fact that it is impossible to turn out an all-round first-class mechanic from an agricultural shop. Numerous cases might be cited, however, to show where graduates of jobbing shops have proved failures in agricultural work, not because they did not turn out the proper quantity, but because they could not produce the quality desired.

Under a system of paying a low price for plain work and a correspondingly good price for particular work, and giving an apprentice a chance to get to the best class, under a fair discount, you give the boy an opportunity to earn enough to pay his board and buy his own clothes, and at the same time the foreman can administer a rebuke to a careless molder by degrading him, as far as the class of work he is asked to do, is concerned, to the level of the apprentice. This is better than firing him out to seek work when there are not jobs enough to go round.

V. L. WOLFE.

Toronto, December 4, 1896.

Chas. M. Power.

Chas. M. Power, vice-president of the American Foundrymen's Association for the Northwestern States, represents that type of American citizens developed by the hustling West.

He was born on November 17, 1859, at Okaman, Minnesota. Two years later his parents moved to St. Paul, where his time has been spent ever since. Obtaining his education in the public and high schools of that city, he entered the employ of a grain firm at the age of 18, and left them to take the position of secretary and treasurer of the St. Paul Foundry & Mfg. Co., on January

CHAS. M. POWER.

1, 1882. In 1883 that company was succeeded by the St. Paul Foundry Co., who procured the present site and erected thereon greatly enlarged buildings. Owing to the retirement of the general manager in 1885, he took entire charge of the establishment, and has held this position since then.

To show how successful he has been in the management of the company's affairs, it is only necessary to mention that during his term of office the capital stock has been doubled, now being $200,000. Improvements and enlargements have been constant, and this in the face of the great changes brought about in manufacturing during the past decade.

Nothing could better illustrate the capability of the man then the fact that they have been able to retain their old customers and obtain new ones, having work on hand when other shops of a similar character have been closed.

Mr. Power is conservative in his business methods. His time has been devoted to the firm he represents, and his name is unknown in politics or outside interests.

Physical Tests of Cast Iron in the Foundry.

BY JAS. A. BECKETT.

Physical tests of the product is a very important matter that is too often neglected in the foundry. In many foundries it is entirely unknown, and in many others it is done in such a careless and desultory manner that the results obtained are practically worthless. Under present conditions tests of tensile strength are not within the reach of the average foundryman, because standard machines of the power required are too expensive. The number of foundries possessing such machines is comparatively small. The great majority of the foundries that make regular tests of their product depend entirely upon some form of transverse test.

In considering the subject of transverse tests we have at the outset to face the fact that at best this form of test has only a comparative value, because so many things have to be considered in connection with the history of each test bar, which go to make up the value of the result obtained. The form of transverse test which is most generally used at the present time is that of the inch square bar broken at twelve inches between the supports, the load applied in the center. The first requisite for this form of test is a machine of some reliable standard make of a capacity of from 3,500 pounds to 5,000 pounds. I prefer the latter, as I believe it will operate easier in proportion than the smaller machine when breaking the ordinary test bars, which run from 2,200 pounds to 2,800 pounds. It also provides a liberal margin for testing bars of extra strength, and for testing the elastic limit of medium-sized bars of steel or iron. For making tests of

transverse strength with the inch square bar it is well to use an iron pattern for the test bar, or, better still, two patterns inch square, fifteen inches long, gated together at or near the ends, with steady pins in the end gates, so as to prevent, as far as possible, an increase of size while rapping and drawing the patterns. Care should be observed to have the patterns planed true to size, and also in making the castings to have them as nearly the proper size as possible. One thing which has done more than anything else to spoil the results obtained by tests of the transverse strength of cast iron in the past has been the lack of uniformity in the size of the test bars tested. Absolute uniformity, while greatly to be desired, is not possible in cast bars, but where it is desired to get close results the weight of the test bar could be recorded, with its exact size and breaking strength. In ordinary practice, however, this is not necessary, if proper care is observed in making the test bars.

I am aware that I am treading upon dangerous ground when I advise the use of the inch square bar for transverse tests. The test bar question as a whole is a dangerous one, and so far as it applies to the foundry, nearly every foundryman has his own views of the matter, and there are many points upon which they disagree. Considerable heat has been developed in the past discussion of the test bar question, but if the time ever comes when it can be discussed in a temperate and purely disinterested manner, I think that it will result in the adoption of the inch square bar, broken at twelve inches between supports, as the standard for measuring the transverse strength of cast iron for ordinary foundry purposes. While there are some objections to the adoption of this size of test bar, there are many things to be said in its favor. The square inch is the unit of area or volume of iron, of which the transverse strength is required. Therefore a square inch should be the area of the bar tested, as it is a well-known fact that when using a smaller bar or a larger one, in order to get the true value of the result obtained per square inch, correction tables have to be used, which are not easily understood by those who usually have the matter in charge. The grain in the fracture of the inch square bar is more nearly the same size as the grain in the fracture of medium-sized castings, especially in those portions of the casting which are depended upon for strength. The principal reason for breaking the inch square bar at twelve inches will be found in the fact that the result obtained at twelve inches is more nearly a multiple of the tensile strength of a square inch of the same iron in the specimens now commonly used to obtain the tensile strength of cast iron. These specimens are usually round and the area equal to a square inch when they are poured from the same ladle as the inch square bar. The operator of the testing machine cannot fail to be struck with the regularity with which the transverse strength of the inch square bar broken at twelve inches proves to be one-tenth of the tensile strength of the other specimen, which is the equivalent of a square inch cast in the same mold. The proportions are not absolutely constant, but the variation is so slight that it is hardly worth taking into account, when we consider the variations which at present seem to be a necessary element in any test of the strength of cast iron. While there is some doubt as to the utility of making tests of the tensile strength of cast iron, it has not affected the demand for such knowledge on the part of engineers and others who are users of castings. Such being the case, the above form of transverse test gives the average foundryman, who is unable to buy an expensive machine to make tests of tensile strength, a means of ascertaining the tensile strength of his product with a fair degree of accuracy—in fact, near enough for all practical purposes—by the use of a machine that is so cheap as to be within the reach of any foundry, however small.

Every foundry foreman should familiarize himself with the use of the testing machine, and note the peculiarities of its product, which are revealed by the practice of making daily tests.

Perhaps much of the heat developed in the discussion of the test bar question might have been avoided if an effort had not been made to establish a connection between the physical test and the chemical analysis of cast iron. If the relation between the two could be established it would be of great benefit in some ways, but as a matter of fact they must be considered separately, for while a change in the proportion of the usual ele-

ments in any given mixture of iron makes a corresponding change in the transverse strength, it is possible and often desirable to obtain the same degree of strength by the use of mixtures of iron which differ widely from each other in chemical analysis.

It is not possible for any one to determine by a physical test of cast iron, the per cent of any element which it contains, or to make the physical test a measure of the influence of any particular element in the iron, unless in the case of a foundry running on a mixture of iron in which all the elements were absolutely constant except the silicon. Such a mixture would be hard to get under present conditions, and if found would probably command a higher price than the average foundry could afford to pay.

Physical tests of cast iron in the foundry are, under present conditions, an absolute necessity, a fact that is admitted even by those who question the value of the transverse test. Every improvement in the quality of the foundry product has been helped along by a more or less intelligent application of this test in some of the many forms in which it has been used in the past. It is to be regretted that there is such a lack of uniformity in the methods of testing, the size and shape of test bars, and the conditions under which they are made and tested, in foundries doing practically the same character of work.

The methods differ so widely that it is difficult to establish the comparative value of the product of a number of foundries, by means of the data preserved in each case. This subject, like every other pertaining to foundry practice has been under discussion at more or less regular intervals during the past few years, and while at present there is an absence of a standard which is acceptable to all, the matter will not be allowed to rest until some satisfactory conclusion is reached.

While prominence is here given to the inch square bar for transverse tests, I do not wish to be understood to detract from the value of the ½" bar for work requiring more than the average degree of softness, or an extra sensitive test. In foundries making very thin or very small castings, physical tests other than the transverse, have always been deemed more important, such as the fluidity test, the shrinkage or contraction test, and the chill test.

The fluidity test takes almost as many forms as there are foundries in which it is used, and varies from the practice of watching the effect upon some particular casting in the regular product of the foundry, to a test of making a thin strip 2"x24" and ⅛" thick, and in other cases strips are used 1"x15" by 1-16" thick. In most cases these thin strips are also used as a sort of chill test or test for hardness, by observing or measuring the depth of chill upon the edge of the strip on the end farthest from the gate, and in the case of the thinnest strip mentioned a test of softness was made by drilling small holes at regular intervals from the gate end of the strip, the requirements of the work were such that unless it was possible to drill the strip a certain distance from the gate end, the iron would be too hard for the smallest castings made in that foundry.

When the requirements are so exacting something more sensitive than the inch square bar will have to be used. The tests used in most cases of this kind are the result of an honest effort on the part of some one connected with the business, to establish a standard by and with which the daily product may be compared, and variations noted and corrected. Some of them have been in use for many years, and when due care is observed in the matter of making the test specimens as nearly as possible in the same manner every day, the results obtained cannot fail to be a valuable aid in securing a greater uniformity.

There seems to be very little prospect of being able to establish at present, a single form of transverse test that will cover all the requirements, and give uniformly the best results for all kinds of castings. Until such a form of test is produced, those who are making castings requiring a sensitive test will continue to use the half-inch bar or the thin strip, but where it is simply a question of transverse strength to determine the strength or weakness of a mixture of iron as compared with some other mixture, the inch square bar broken at twelve inches between supports, will be found to be the most popular form of transverse test, and sensitive enough for all practical purposes, until the

average foundry practice is considerably better than it is to-day.

Down Draft Core Oven.

By W. L. HAYDEN.

DETAILS ABOVE GROUND.

This method of draft is by no means new to the world, but having been in the past almost exclusively used in kilns for the vitrification of paving brick, sewer pipe, etc., the adoption in core ovens is less frequently found. The writer having experimented by actual test, thought it might be of a benefit to explain its cardinal worth to those who have given the matter little thought. I shall, in my first article, take up the exterior and interior construction above ground; in the second, the underground construction; in the third, explain the practical reasons why down draft core ovens are superior to up draft. To get a general view of our wall arrangement, ground plan (Fig. 1) can be followed so that a closer idea will be obtained by the following explanation:

The size of the interior can be of any dimensions suitable to the work it has to accommodate. For a general foundry of ordinary output the dimensions here given would probably be amply sufficient for all demands (A. A. A.), being our three main walls, we notice that one of the side walls is 12 inches thicker than the rest, being built thus so that sufficient depth can be obtained for building fire boxes (C. 1 and C. 2). These fire boxes can be built in several ways, all equally good, but the most easily constructed and probably the most lasting would be to cut arched holes through wall (as shown in Fig. 3).

Allow a wall of double brick thickness to

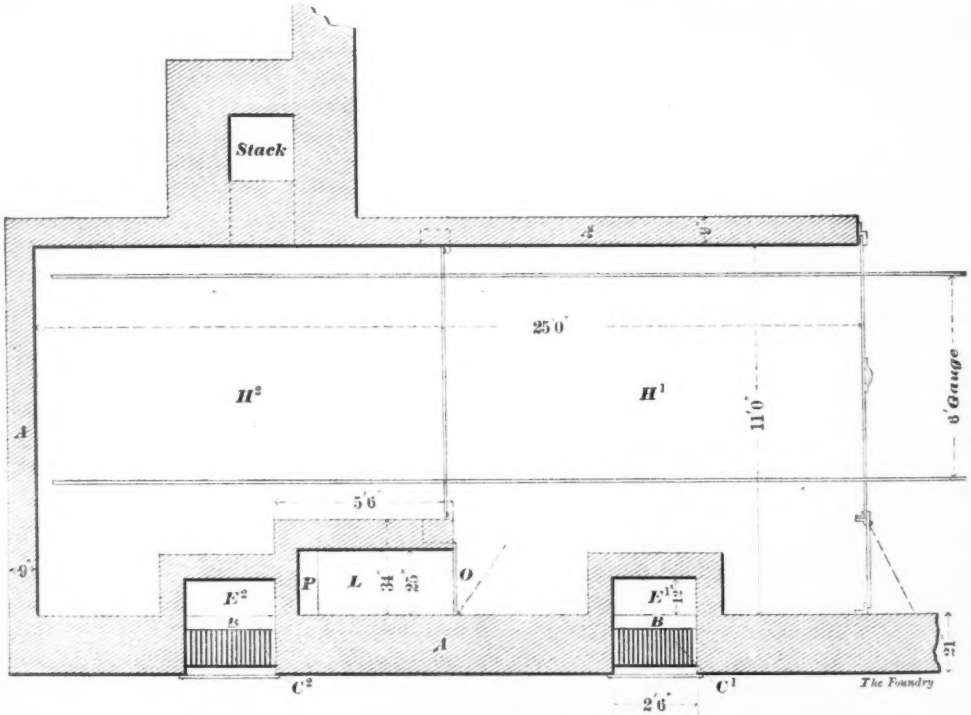


Fig. 1. Ground Plan

be built in back of fire holes flush with inner side wall, extending from bottom of fire hole to the foot of arch (as shown by B, Fig. 3). Place then a square iron bar (M) almost flush with outer wall, with about three-inch bearing surface in side walls of fire hole, at sufficient height from ground to be about 6 inches lower than top of back wall (B). Hook on this bar, about two inches apart, grate bars of cast or wrought iron (as shown by Fig. 4), allowing the straight ends to rest at the intersection of bottom and back wall. With

this completed, we have a fire box easily fed from the outside, with good air space below grates and no projection to occupy space, in case room is limited.

In some cases it may be found necessary to set in main wall four hinge blocks, and on two of these swing a cast iron door (F. 1.)

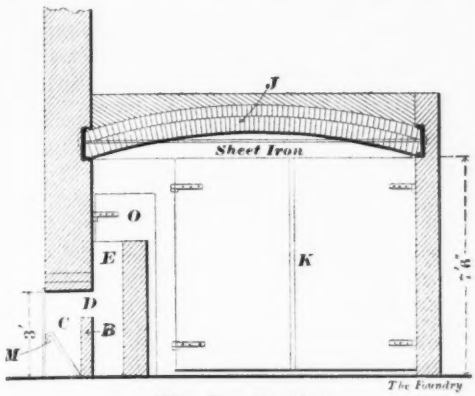


Fig. 2. Section

large enough to close opening in wall so as to gain full benefit of hot air and gas generated by combustion of fuel. The door should in this case always clear the ground, leaving a draft space of at least 6 inches. If low draft is desired a 6-inch door can be hung on the remaining two hinge blocks in the same manner as (F. 1.). With this simple arrangement a perfect control of fire can be had by the attendant. Ventilator G. can be opened after both doors have been closed if still lower heat is needed. (Fig. 5 E) represents fire bag built on inner wall exactly op-

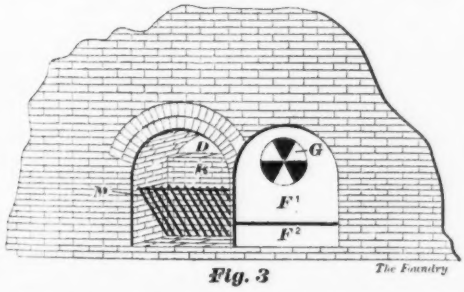


Fig. 3

posite inlet hole (D), extending from the ground to within three feet of the top of side wall. The heat thus pocketed arises from the open end of fire bag (Fig. 5) and collects along the middle of arched roof (J, Fig. 2) the entire length of core oven. The arch of the roof greatly depends upon the width of the core oven, and should spring about nine inches, so as to give easy slants to the air and gas attracted to the floor by the down draft. Having lodged itself as above described, the hot air meets with a counter attraction and is diffused in equal density throughout the oven in a downward direction. The cause of this attraction and general plan of construction will be taken up in detail in my next article.

Passing on the inside, we find two fire bags (E. 1., E. 2.), one in the first chamber and the other in the second. Between these chambers or ovens a portable partition in the form of two wrought iron doors (K) are swung on hinge blocks set in side walls. These doors when closed make chamber No. 1 a separate oven, allowing one fire to be kept up with the same generation of heat when the work is such that one-half of the capacity is sufficient. In this way we obviate

Fig. 4

burning fuel in fire box (C. 2.) when the space is not needed.

The door at entrance of core oven must be equal to the width of doors (K), both giving the same clearance for car. It is best to construct this door of boiler plate and angle iron, running standards up above core oven equal to its height. On the top of the standards sheaves should be placed in suitable yokes, and over these sheaves chain or wire ropes should be run, with each end fastened to upper corners of door and the other ends fastened to weights sufficient to counterbalance, equally or possibly a little less, the weight of door and its friction on guides.

With this simple arrangement, we have a door that is apparently clumsy and heavy, but easily raised and lowered by one hand. The remaining width of chamber No. 1 is filled out by another small iron door swung

on hinges so that one can enter core oven without disturbing the large sliding door. When entering the small door, even though car is in oven, we have a good walkway to oven (L). This oven, as shown in Fig. 1, is built up to and joined to the arch. The front stands flush with doors K, having an entrance from oven No. 1 by small iron door (O), and is arranged with sliding shelves, the ends of which clear the back wall about 6 inches (at P), when shelves are in their proper place and door (O) is closed. These shelves when entirely covered will accommodate a great number of small cores. The fire box is placed directly under lowest shelf, the heat

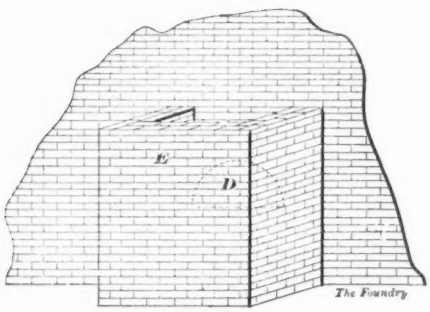


Fig. 5

from fire arises the full height of oven, behind shelves, and has its exit at the top of oven directly onto arch.

Of course this oven is seldom used, only when the large oven is cold and a few small cores are needed for immediate use. Fire brick of the best quality should be used as a lining for all fire boxes and interior of core oven, although I have found that when the core oven is lined with well vitrified brick, thoroughly glazed by the silicate of soda, at all times makes a cleaner oven and resists the settling of soot and dust upon its smooth surface, allowing it finally to be carried out the main flue. This part of the construction can be entirely left to the discretion of the builder.

(To be continued.)

Some Pencil Sketches of Failures.

By HENRY HANSEN.

I want to pause for a moment's reflection among a few minor details that sometimes cause us to rub onr head, while we administer to our conscience the opiate, that we done right, all the time feeling that our guilt is hidden somewhere.

When anything goes wrong, the proposition that we done right is a hollow mockery. It is an imposition on our inner self, and we can not hold it up as a ray of hope without feeling that others are able to penetrate so thin a shield of deception. When anything goes wrong, we may as well plead guilty, locate our erring ways, and do better. This induces a good night's sleep, a clear head the next morning, and a favorable start for a good day's work.

A great many cores have to be set in the mold with the aid of hooks, making it necessary to fill these places in afterwards. Having noticed many castings that showed imperfections around such places causes me to stop before it, as it is a failure, which, it is true, sometimes "hurts nothing," but then again, it ain't right.

My first experience in stopping up around a lifting hook, was with a core for a fair-sized box column. The old man gave me a show, and it made me feel like a certain man in Canton, Ohio. Things were going my way, and in boyish exuberance I bossed the helper around till my throat got sore. The molders didn't appear as if they enjoyed my performance and gave me a wide berth, and, feeling like retaliating, I made up my mind that if any ostracizing was to be done, I could take a hand in it, too. But it doesn't hardly do for a boy to cut off all reciprocity with his shopmates, and in a few hours I was stuck. I had never noticed how the molders stopped up around the hooks. Here was a dilemma that I hadn't provided for. To be sure the old man would tell me, but that would, in my estimation, detract from my glory. Just then the coremaker came over and accosted me with the admonition, "Don't forget your lifting hooks, Henry." Earlier in the day I would have told him that I was running that job, but just then I felt he was my savior. Such is human nature. When I told him of my predicament and he offered to do the job for me, I made the promise that when pay-day came around, I would buy him the biggest beer to be found in the town.

Now, what I want to tell the reader is how he done this stopping up. I remember, because I watched him as I had never watched anything before. First he put on a liberal

supply of paste and after putting in a handful of facing sand, rammed this down solid with a hammer handle, then he drove some nails around the edges of the hole, to hold the sand, as he explained, and when the whole thing was filled up and sleeked over he took a can of black oil, used for lubricating the crane, and poured about half a pint on the part of the core where he had made the patch; enough to make a muddy pool. As I was after information just then, he told me confidentially that the oil was put on to hold the green sand, and that it had to have a good soaking to become effective.

I never disputed his word, but thought to myself that here was an example of good securing—first paste, then nails and lastly oil—not much chance for that sand to get away. What was my surprise, therefore, the next day to have the chipper ask me, "What do you call this?" Around every lifting hook was a bunch; didn't hurt anything in a column, but it was food for thought just the same.

To be sure, the coremaker done it, but he only done what hundreds of molders are doing to-day. He done it without a thought, and thought he was right. Will anyone on second thought, suppose that iron will lay against green sand saturated with paste? As for oil, I am a kind of down on oil in the foundry on account of the harm I have seen it do, and will explain the reasons for my hostility to this product.

We all recognize the great desirability of confining gas and gas producing materials to the minimum in molds. Every drop of oil we introduce, however, is only another name for so much gas, one oil being capable of generating more gas than others. Why molders should put in their molds the very thing they want to get rid of is one of the anomalies of the trade. Nor do I want you to take my word for the evil effects that oil produces in molds. Try it for yourself, this way: Make a small open sand bed, such as you would for any open sand work, and be sure to make it soft enough so that the iron will lay on it. What is better is to divide it in two parts, and in one pour some oil of any kind. Let the agitation of the metal in the oily part be a lesson to you that oil accomplishes no good and is a positive detriment, a dirt producer of the first type.

What we need to do around a lifting hook is to act like we would in any other position where we wanted to get a good casting. Just enough paste to slightly moisten the broken parts of the core, careful ramming like any other part we desire the iron to lay to, and we save both muscle and worry.

Such places are sometimes filled in with core sand and dried with hot irons, but the slowness of this operation to make it thorough renders it extremely unpopular, green sand being in every way as good for the purpose if it is only handled like green sand ought to be.

Some molders will mix up what they call "stiff blacking" for plugging up vents. This is not as bad as the oil, because the only objectionable feature connected therewith is what little water the blacking contains. But looking at the matter, I dare say that none of us would expect iron to lay quietly on a body of such material, so why should we use it when we know it is not good in the first place.

Some will go behind the cupola and borrow a handful of Paddy's clay when they have anything to plug up. Now who expects hot iron to lay against wet clay without making an objection?

I had a most difficult job on hand once to convince a foreman that he had a hand in making dirty castings himself, to which the general manager objected on general principles. He was using a mixture of oil and new molding sand for plugging up vents, and when I expostulated with him and explained how his castings got dirty and refused to stand the hundred pounds pressure put on them without leaking, he retorted that the cores themselves were made with a mixture partly composed of oil. I thought that baking the core somewhat altered the chemical composition of the oil, but he remained obdurate until I secured a handful of his plugging material and showed him the agitation it produced in the metal and the dirt that was generated thereby.

Oil on chills is another hobby with some molders and foremen, too, for that matter. It covers a multitude of dirt and rust and is applied evidently to offset the neglect of taking care of the chill in the first place. Iron will lay quietly on iron that is clean and free from moisture, and why we should in-

sert such a gas producing material as oil in places where the gas must escape through the metal is one of the things I would like to have some of my shopmates consider.

There is many a habit of this kind clinging to us which we would discard the moment we stopped to think. Why not think?

Determining of Carbon in Iron.

Mr. Peipers, an engineer at Remscheid, has introduced a method of determining carbon in steel which is similar in principle to the assay by touch in use for gold. A series of test bars of known carbon contents, and varying from each other by about 0.2 per cent. between the limits 0.2 per cent. and 1.2 per cent., form the touch needles, while touch stone is represented by a slab of hard biscuit porcelain. The bar is hammered and filed to a blunt conical point, which leaves a black mark when rubbed on the porcelain slab. The sample to be examined is rubbed upon the center of the plate to form a patch of about the breadth and length of the finger, a similar one being made on either side of it with two of the bars whose composition is known. The chief point to be attended to is to make the patches uniform in depth of tint, which can be readily done with a little practice. The marked slab is then immersed to about half its depth in a breaker containing 12½ per cent. solution of copper-ammonium chloride in water, which dissolves away the iron from the immersed portions of the patches, leaving the carbon behind as a gray stain, whose intensity increases with the percentage proportion. Steel with about 1½ per cent. of carbon is nearly as dark after as before immersion, while that with 0.25 gives only a very pale shade when the iron is removed. If the metal were perfectly free from carbon, the mark would be completely dissolved.

Numerous substances have been tried for streak plates, including agate, Arkansas stone, hard glass and feldspar, but none of them has been found equal to unglazed porcelain. In its ordinary state, however, the latter is too rough to abrade the metal equally, so that it must be rubbed down with coarse emery cloth to render the surface sufficiently uniform. The markings may be nearly completely removed by washing in water, but a more satisfactory method is to clean the slab by immersion for 15 minutes in nitric or hydrochloric acid, which removes rust spots and stains, and restores the orig-

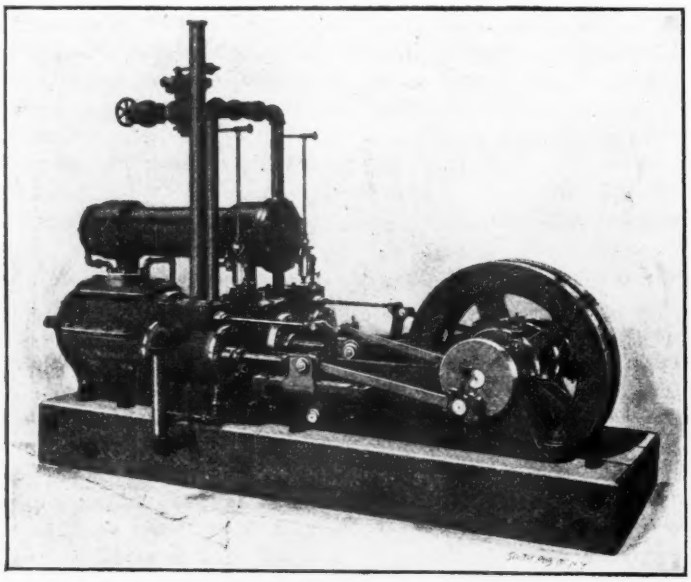


FIG. 1—TRIPLEX COMPRESSOR.

inal white surface. The method is capable of indicating differences of 0.05 per cent. or 0.025 per cent. of carbon under favorable conditions. The cost of the apparatus is about $5.25.—Ex.

A Progressive Foundry.

A vast amount has lately been written about the many economies effected in foundry work by the use of compressed air, but comparatively few foundries seem to have investigated the matter sufficiently to convince the management that they could save money by the adoption of a pneumatic system. Proverbially the shoemaker's children go without shoes, but the foundry of the Ingersoll-Sergeant Drill Co., at Easton, Pa., seems to be the exception that proves the rule.

This company operates nearly all its foundry machinery by compressed air at 100 pounds guage pressure.

A mammoth air compressor called "Jumbo," furnishes 1530 cubic feet of free air per minute, running at 90 revolutions, or 17 cubic feet of free air per revolution.

This is a "triplex" compressor with two 18x24-inch steam cylinders and two tandem, compound double acting air cylinders 28x17x24-inch with an intercooler mounted on top of and connecting same. The steam cylinders are fitted with Myer adjustable cut-off valve gear. Diameter of fly wheels is 7 feet, and the total weight of the compressor is about 51,000 pounds. From "Jumbo" the air passes into large receivers or storage tanks from which ample piping conveys the air to all parts of the establishment and is used in a great variety of operations. The foundry proper is a steel and brick structure 160x80 feet, with a cleaning shed 80x26 feet; sand blast room, 26x20 feet; and two core ovens 20x20 feet, and 20x10 feet, respectively. The pattern shop, which adjoins the foundry,

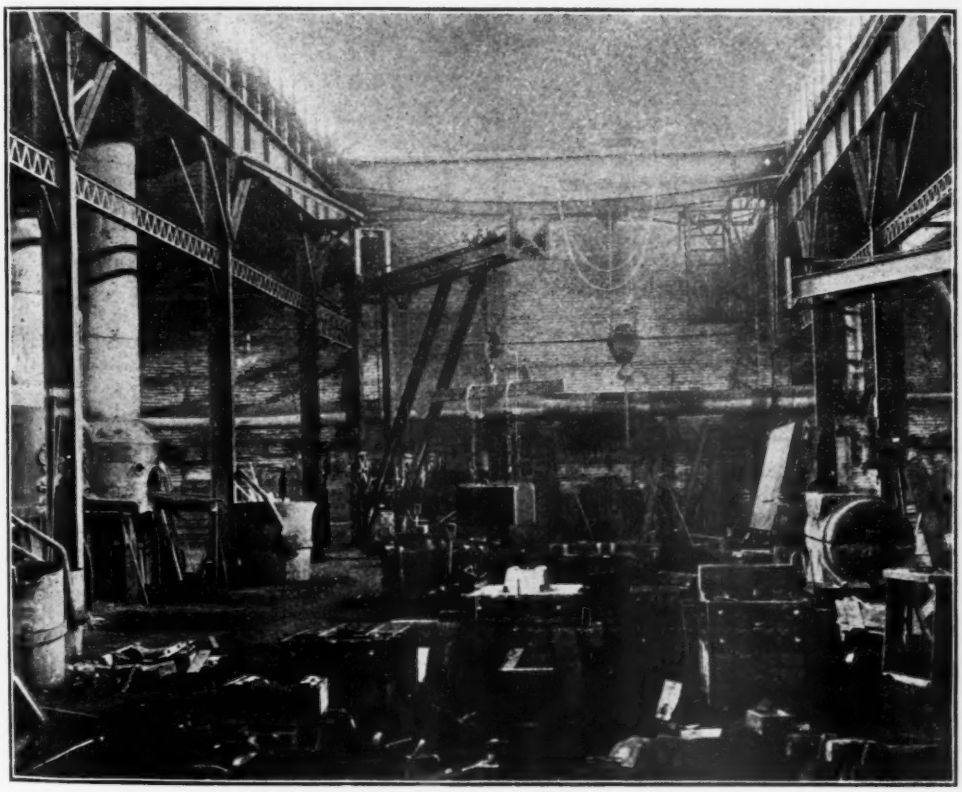


FIG. 2—INTERIOR VIEW OF FOUNDRY.

is a two-story structure 80x100 feet. The usual bins for sand, coke, lumber, etc., are located adjacent to the foundry under an elevated railroad siding, from which these supplies can be dumped from the cars through chutes without further handling. The traveling crane over the main floor is of ten-ton capacity, and is operated by four and three cylinder air engines. Compressed air cranes are especially desirable for foundries, as in addition to doing away with gearing or belting, and hence making the cost of installation much less, the dust and heat have no deleterious effect upon an air motor, whereas, these two causes are frequently sources of endless trouble, particularly in the case of cranes operated by electric motors. A Ridgeway eight-ton hydropneumatic jib crane takes care of part of a side floor, and by a peculiar feature of this type of crane, only sufficient air is used per lift to overbalance and raise the weight desired—the same water being used over and over again.

Three smaller jib cranes of one and two-ton capacity take care of the light work. A two-ton traveling crane in the cleaning shed is equipped with an air hoist of the horizontal pattern. This arrangement is often desirable where there is a lack of head room. The elevator for the charging floor is also operated by compressed air and handles quickly and easily all the iron for a 15 and 10-ton cupola.

A Tabor pneumatic molding machine makes a number of the parts for rock drills and by its use savings are effected at a rate varying from $300 to $3,000 per annum, according to the intricacy of the pattern. Metal patterns are almost exclusively used on this machine, and compressed air is used in addition to running and rapping, for blowing off the sand that sticks in the interstices of the pattern after it is drawn, thus doing away with the bellows and brush. Indeed, air jets around the foundry have supplanted these hitherto indispensable tools.

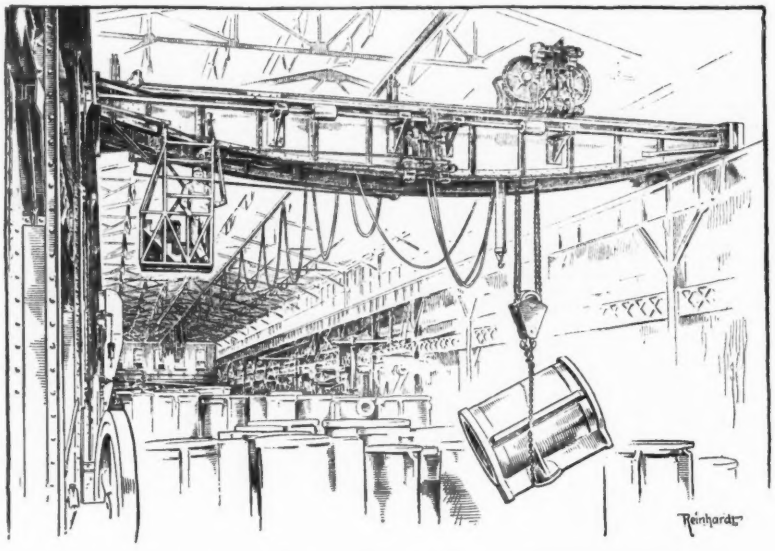


FIG. 3—TRAVELING CRANE OPERATED BY COMPRESSED AIR.

Portable sand sieves, driven by pneumatic motors, direct acting air hoists and pneumatic chipping tools, each fill a place in the air equipment of this foundry.

A Tighman sand blast machine cleans the many difficult castings made by this company, which before the introduction of this machine could not be done by hand in a satisfactory manner. All standard size flasks are made of cast iron. Many of the small cores are quite difficult to make, and a number of the core molds are of very ingenious construction.

The Arch Enemy and How to Control It.

By L. C. JEWETT.

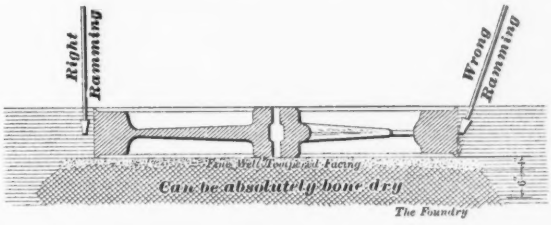
It is to the unskilled and novice this is respectfully indited. "Vent! Vent!" Every molder, apprentice, laborer and coremaker in a foundry is early and constantly being made acquainted with the foundryman's "arch enemy," vent, as it is called. This is a misnomer, for vent is simply an outlet for the pent up gases that refuse to stay pent up in a mold. If they do not have vent they begin a war at once, but in this connection the reader familiar with foundry parlance will know what is meant by vent as we use the term.

To provide ample and generous outlets for vent is one of, if not the paramount safeguard, to insure against unsoundness, produce smoothness and prevent dismal disaster in the production of castings. One should ever be mindful to so construct the various parts of the mold with such material and in such manner as to avoid making vent, to reduce it (the vent) to the lowest possible minimum and keep the strength requisite to withstand the force, weight and pressure of the metal when poured.

In the construction of fly or balance-wheel molds, as per sketch, where numbers are made in succession, the practice is where there is sufficient floor space to have two pits; while one is being rammed up the other is opened and is cooling off. The preparing of the pit—digging it out and tempering the sand—is usually and should be done by the helper while the molder is finishing the mold ready rammed up.

Right here, ofttimes, a great deal of mischief is done. After the casting is removed water is thrown in by the helper "ab libitum," with bucket after bucket with fiendish delight if a hose is one of the luxuries; then he serenely plays the stream into the smoking, steaming pit, fixes it into a temporary position, and goes over to the neighboring floor, ostensibly to assist with a lift, but veritably to "gain," as the sailors say, "swap stories," or settle the destinies, financially or politically, of some country. Once it was "Parnell and Ireland's woes," now I suppose it is "Weyler versus Maceo," "Cuba for the Cubans," "Viva la Libra," whatever it is if the boss is in a good safe place. It takes considerable time to exchange sentiments, meantime a young embryo lake has, and is, forming in the pit. When it is shoveled out to required depth for the next mold there are piles of wet muck on the banks and a pit reeking from excess of water. It is an even bet if the helper don't throw in one or two more pails of water, or squirt the hose some more to make it look finished and wetter. When a casting is made under the before mentioned conditions a bad "un" is the result.

Then the self-appointed jurors bring in their verdicts as to cause of cadaver. First,



"That ere sand is too close for that kind of a job, that's why it scabbed." Second, "That ere sand ain't close and tough enuff, that's why the cope scabbed." Third, "I guess yer got it a little too hard didn't ye?" Fourth, "She was poured too blamed hot, there's yer trouble, see." Fifth, "Oh, your foolin' yerself, twan't hot er nuff; see them ere wrinkles in the rim." All this, and more, of honest convictions, bluntly spoken but nevertheless prompted by brotherly sympathy, for in the foundry a loss of a casting of any magnitude like the poetical stroke of kindness makes the whole shop's crew akin. But few, and rare they are, who remember the wet bottom of the pit, and heavy sand; and while the vent came off seemingly free and plentiful. But how much were to come off, or would have came off, if it could have got out to let the liquid iron fill without agita-

tion? No one seems to inquire or know. We will start to construct a mold under the principles as shown in sketch, with reasons why and wherein the advantage lies:

The sketch shows a ball-wheel as made in green sand practice rammed up in the floor ready for the cope.

The crossed lines can be absolutely dry —that portion can be left nearly as when the casting is removed. It should, of course, be spaded up and lumps pulverized to make it uniform in porous density.

On top of this a layer of well-tempered, riddled sand some 4" deep is placed, and a dressing on top of this again of sea-coal facing sand 1" or so deep. Then proceed with a good, large 3" or 4" plank or timber with iron bar to tamp or ram the pattern down with not too hard but just hard enough blows given all around the rim while hub and arms are to be tucked up later.

The purpose of the dry sand in the bottom stratum is to receive the steam as generated by the hot metal from the water in the 4" or 5" of tempered sand, which being colder than the steam condensation takes place, and being dry the moisture is absorbed and cannot return or will not return back into mold to agitate the liquid metal, causing dross wrinkles and scabs on bottom and destroys the cope by lapping up to it before the mold is filled and sufficient pressure gets on to hold it still, thereby causing particles of sand to move, and it is called scabbing.

As it takes up the water the dry sand becomes more firm and less liable to yield to strain of mold. It saves labor as it does not require moving from the pit. It saves labor as less water is required.

In ramming up cope of this kind, while it is a safe practice to put gaggers right down on the pattern with but little sand under them on the rim portion of pattern and place them close together not over 3" apart, well clay-washed, ram good and firm over rim with a good 5" or 6" of sand the first ramming, and when cope is finished blow or sprinkle molasses water over after blacking and a draw down is not likely to happen. If the cope is quite damp when closed in no evil effects are likely to result, as a deep junty fly-wheel, rim 6", 8" or 10" in cross-section the cope will be pretty well baked from the hot iron while mold is filling before the liquid metal strikes it.

In conclusion, I will call attention to the points in sketch where rammers are shown. One says wrong ramming, a careless or aimless method of ramming will sometimes make such a blow with the rammers, and when pattern is removed a place is seen that looks close and dense, or bruised; this place is quite certain to scab, or there will be an excrescence on the face of rim that when removed reveals a dent sometimes below the finishing line.

The rammer marked "right ramming" it will be noticed stands at an angle slightly away from the pattern. Blows delivered in this manner or perfectly perpendicular, 2" away, never nearer, can do no harm however hard they are struck with either pene or butt.

Try the all-dry base, gentlemen, for such jobs, plates, fans, etc., either in nowel or pit where extra soundness is required. There will be less hopes deferred and foundrymen less frequently sick.

Notes from Pennsylvania.

Craig, Ridgway & Son, Coatesville, Pa., makers of the Ridgway Hydraulic Crane, are busy as usual.

The Slaymaker, Barry & Co., formerly of Lancaster, Pa., have removed their plant to Connellsville, Pa.

The Union Lock Works, Lancaster, Pa., are running full; business much better than before the election.

The Bridgeton Iron Works, Bridgeton, N. J., are running full with orders ahead and more work in sight.

The Gray's Ferry Foundry & Boiler Co., Philadelphia, Pa., are running full time with orders ahead and more coming.

Blankley Bros. & Co., Philadelphia, are very busy. This firm make a specialty of large complicated castings.

The Moore-Whitton Co., Philadelphia, are full of work and expect soon to make room for more molders.

Charles Lanning, Bridgeton, N. J., is running full time on a patent window sash-weight.

The Downingtown Manufacturing Company, of Downingtown, Pa., have quite a large increase in their business since the election and are running full force.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

To Reduce Shrinkage of Castings.

How can we reduce the shrinkage of our castings so as to show .125 in a 1-2 inch test bar?

Answer.—There is no need to name any special mixture. I think you can get lower shrinkage if you use largely southern irons. By increasing silicon to about 3.25 by using a southern silvery iron or some silvery iron with phosphorus as high as 1.50 per cent. you will be able to get the shrinkage down. Such iron is, however, only suitable for very thin castings, such as stove plate or hardware castings, and will produce spongy spots in heavy castings.

Poor Coke and Silvery Pig Iron.

"I use three irons in my mixture. When I happen to get a poor car of coke the results are all wrong and I have several hundred pounds of broken castings. I have asked our superintendent to furnish me a good silicon iron, and I tell him that I could with it counteract the evil effects of the sulphur in the coke and could stop the shrinkage and prevent the breakage, but he says that if I use silicon with poor fuel I will make the iron as rotten as punk?"

Answer.—It is not the sulphur alone that produces the breakage. It is a good rule to purchase for thin castings southern iron made from all red ore, as this generally has less tendency to chill, but some southern brown ores will make non-chilling iron. There is no need of buying high-priced silicon iron. Purchase No. 1 or 2 soft southern instead of No. 2. With your thin castings you should keep the silicon about 3 per cent. or even higher and then you would not notice any slight change in coke. Your trouble comes more from irregularity in your pig iron than from your coke. Instead of three brands you should use five or six brands so that any chance variation in any one will not affect your castings.

Smoky and Glistening Coke.

A correspondent has sent us a sample of coke dark and smoky on one side and on the other smooth and silvery. He thinks that this shiny portion is slag and wishes to know if such coke will not injure the iron that is melted with it and cause blow holes.

Answer.—The sample is the best coke that came from the oven. It came from the hottest part near the top. The coal was melted so as to run and it was the drops of this semi-fluid coal that became coked and formed the shining silvery surface. The smoke from the colder part of the oven below has filled the cells on the other side of this piece with soot. The coke made from the melted coal is the purest coke that can be found and the smoky coke is often the most thoroughly coked of any. This has no relationship to nigger heads. These latter are from the coal that lies on the colder bottom of the oven where the heat is insufficient to fully coke it. A few inches higher up the heat is greater with the result that each piece of coke stands on a head which is about half coal and consequently bulky and black. A nigger head will not make as much heat as coke that comes higher up. The slate in coke is worse than worthless, and the sulphur should be low. Red spots may be clay or may be iron ore and the latter often contains more sulphur than the bright coke. The irridescent parts do not indicate sulphur and are colored by the gases in the oven. Good coke free from sulphur will make better castings than the poorer grades which are high in ash, and it will generate more heat. The fear expressed regarding the sample sent us shows how apt founders are to blame the coke.

A Mistaken Idea Regarding Cast Iron.

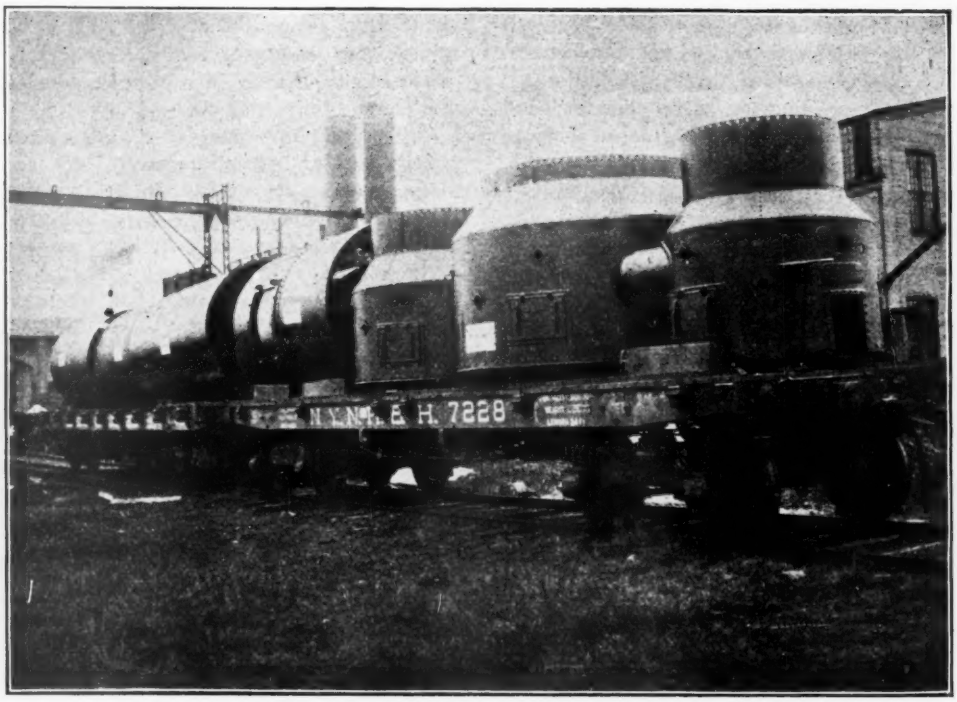
"Will you kindly give the analysis of foundry iron 1, 2 and 3, the analysis that will make an iron that will work advantageously by itself and carry 50 to 60 per cent. scrap?"

Answer.—As pig iron is graded by the appearance of the fracture and of the surface of the pig the silicon will vary considerably, but it is expected to contain about 2.50, 2.00 and 1.75 per cent. Large castings require much less silicon than small castings and scrap being made up of large and small castings is a very uncertain element in foundry work. If the scrap is carefully assorted according to size the silicon may be approximated, for stove plate about 2.75 and

for heavy machinery 1.50 per cent, intermediate sizes having percentages coming between these extremes. The size of the castings to be made will indicate the silicon required and the silicon in the scrap being approximated the silicon required in the 40 per cent. of pig iron can be also approximated. There are many pig irons that would be graded as No. 3, but which contain 3.00 per cent or even more silicon, and No. 1 sometimes contains as little as 1.00 per cent. The silicon is the scrap-carrying element and the right amount must be put in the casting.

---

employed is of the circumferential softened blast type, and the lower row of tuyeres are fitted with vertical adjusting devices to permit a variation in the depth of the fuel bed to suit different kinds of fuel. Tangental blast nozzles are used, and 3-16" steel air chambers. The upper tuyeres have a set of dampers permitting them to be closed if desired. Each cupola is provided with an improved blast measuring device. The cupolas are now being erected and were manufactured and supplied complete with brick lining by the Whiting Foundry Equipment Co., Chicago. The new foundry to which they



Foundry Equipment for the Government.

Apparently Uncle Sam intends going into the foundry business. The cut herewith shows a recent shipment of three Whiting cupolas to the United States navy yard at Washington, D. C. The largest cupola will have a capacity of from fifteen to eighteen tons per hour. The second in size ten to twelve tons, and the small cupola five tons hourly. They are constructed in accordance to government specifications with heavy steel stacks fifty feet in hight. The tuyere system are designated is to be one of the finest government foundries in the country. O. K.

The York Manufacturing Company, of York, Pa., have closed contracts for 500 tons of large castings and more in view since the election.

The Hanover Foundry & Machine Co., Hanover, Pa., are quite busy on a new water wheel they have gotten out called the "McCormick New England Turbin Water Wheel."

THE FOUNDRYMEN'S ASSOCIATIONS.

Philadelphia Foundrymen's Association.

The Foundrymen's Association met at the Manufacturers' Club, Philadelphia, December 2, when P. D. Warner, the newly elected president, presided for the first time.

The executive committee gave a review of post election trade and a summary of the financial conditions, concluding with the opinion that we are slowly but surely entering an improvement in the trade. Mr. Evans read some letters from foundrymen in different sections of the country, the majority of whom agreed with the executive committee as to better times being near at hand.

After a brief address by the president, J. S. Steveling, of Harlan & Hollingsworth Co., Wilmington, Del., read a paper by Thomas D. West on "Utility of the Test Bar and Standard Systems for Comparative Tests" of which we reproduce a part:

Many lose sight of the real utility of test bars. They entertain the idea that they will give the actual strength, contraction or chill of single castings. The only way to get these qualities is by making test bars of the same thickness and form, if possible, as those of the casting for which comparisons were to be drawn. In reality this would mean making two castings and breaking one to get the strength, etc., of the other. The true utility of the test bar is simply comparative, to define differences that may exist in mixtures of the various "grades" of iron, or, in other words, all that the test bar will do is to denote the strength, etc., of the iron which is poured into the mold; and what the shape and size of that mold would do to distort the physical qualities of the iron from agreeing with what the test bars have recorded, is largely left for experience to guess at or comparative tests of broken castings to define.

Where there are many duplicates, as in the manufacture of car wheels, pipes, etc., we can by breaking a few castings and test bars have been cast out of the same ladle of iron, obtain a very fair base as a standard for future comparisons of what may be expected in the castings themselves from test bars cast from future mixtures. This is not saying that single castings made of the same pattern, cast at different times could not have any knowledge imparted of their strength, etc., by reason of using a proper test bar, cast with the same ladle of iron. In most all such cases, the test bar is of much value, and the best means that can be employed in enabling the builder and purchaser of castings to judge of what either may expect the actual use of his castings to demonstrate. If a casting stands severe usage and the builder or buyer has a record of test bars that was poured of the same iron with the casting, he generally can rest fairly assured that, if at any other time he should get another casting made, with a test bar that would show a similar strength, he would have a casting that would be fairly equal in strength, etc., to any previously made. And again, the use of these can often prove protection to builders that have machines broken by claimants for unjust damages, as for instance, in the case of punch and shear castings, which are often broken by reason of carelessness on the part of workmen or attempts being made by the proprietors to utilize a machine above the strains guaranteed.

The value of a test bar has never been appreciated in its right sphere, to the degree it should be, but the writer believes the time is not far distant when the machine shop will be as interested in the test bar as many engineers and founders are to-day; and when this time does come, the utility of a standard system will be strongly forced upon us and no doubt an effort will be made to establish and recognize standards for physical tests. How are we going to be able to make intelligent comparisons with our own records or those of others, where we find bars as small as one-half inch square to two inch square being used, and some of rectangular form, and again it can be said, in all kinds of lengths, from a foot up to four feet long, so that we practically find hardly two founders using the same form or length of a bar, or builders and engineers exacting the same character of tests?

Present practice shuts us up like a clam, and makes us dead to all the benefits which a standard of physical tests could insure. Progression demands something broader and of more correct utility than the present practice insures.

The discussion which followed was partici-

pated in by Messrs. Sterling, Christie, Whitney and Prince, each enlarging upon the points brought out in the paper.

Pittsburg Foundrymen's Association.

The second regular meeting of the Pittsburg Foundrymen's Association, recently organized in Pittsburg, was held in the rooms of the Builders' Exchange, in that city, on Monday evening, November 30. The committee appointed at the previous meeting to secure permanent quarters for the association reported that satisfactory arrangements had been made with the Builders' Exchange, by which they will have the use of a meeting room one evening during the month and as often in addition as may be necessary. The subject of "Tests in Foundry Practice" came up for discussion, which was participated in by nearly all the members present. Entertaining and instructive talks were had from Messrs. Seaman, Boyd, Wilson, Taylor and others, the discussion being of much interest to all the members. After the transaction of some unimportant business the meeting adjourned. The next regular meeting of the association will be held on the fourth Monday of December.

New England Foundrymen's Association.

The November meeting of the New England Foundrymen's Association held was made notable by the presentations of four papers, all bearing on the subject of foundry costs. We present the following abstracts, the authors' names being at the present unknown to us:

1. We do not have any good system for keeping the actual cost of any one piece that goes through our foundry without devoting special attention to it. We know the average cost of our melted iron and general expenses and have simply to add our molding and cores to that. In figuring a job we know how much our general expenses for a year average to each man—that is, to the average number of men that we employ. Thus we figure the number of pounds of iron in the job, find the cost of our iron and estimate the number of days' labor for one man to make it. We multiply that number of days by the average general expense for one man per day and add the estimated labor and profits.

2. To find the other items of cost—that is, labor and expense—is not so simple. Indeed it may be set down as impossible to frame any formula that shall exactly meet the first requirement named at the commencement of this article—viz., absolute accuracy in reckoning costs. There are too many indefinite factors, too large an element of uncertainty and risk in practice, and too many variable quantities. Still it is believed that the following plan, if carefully followed, will fairly meet the second requirement mentioned—viz., estimating new work with reasonable accuracy. The first step is to learn the total fixed charges for any given time, preferably for one day, as in the case of iron and melting. Under the head of fixed charges the following are to be included, and for convenience they are to be reckoned for a year, and the total divided by the number of working days in a year: Rent or interest on investment, taxes, insurance of all kinds, depreciation of plant, water rates, lighting, heating, office expense, superintendence, power. There are other charges which vary with the volume of business done, but which can be reckoned approximately from the books of the previous year's business, such as teaming or freights in delivering castings, carpenter's time and lumber in keeping flasks up to value and barring off and altering same. Then there are also the supplies, core sand, molding sand, facings, flour, beer, small tools, brushes, rammers, shovels, etc., coal for core ovens, and all the thousand and one petty items which constitute one of the great "outs" in the foundry business, and which are usually charged off on the books under the comprehensive heading of "miscellaneous expenses." Then add as much as your self-esteem will permit and as little as your conscience will allow for "bad debts." Count in under the head of "unproductive labor" every dollar of your pay roll except the molders, core makers and chippers, and by that time you will begin to realize that the reckoning of costs in a foundry is a very serious matter, and that it differs greatly from any other reckoning of costs that you know of. You will wish at once to raise the prices of every customer on your books, for you will begin to understand what a load of expense each pound of your output has to bear.

After you have got the total of all these items for one year or for one day, as you choose, ascertain what you have paid your productive help, your molders, core makers and chippers, for the same time, and divide the sum you have paid them by the total of all the expenses as indicated above. Your answer will be the proper percentage to add to your wage account to cover the actual cost of your labor and expenses.

3. Now, to make our meaning somewhat clearer we will state how we should proceed in a given case to find how much it would cost us to make one casting of a certain kind. First ascertain the weight of the casting, then the following items of cost:

(a) Iron. This we get from the average cost of the pig iron and scrap used per 100 pounds of castings made during the previous year, as above explained, or if the market price of pig iron and scrap has materially changed from the present price of the same. The former method has the advantage that it covers all loss from imperfect castings returned.

(b) Labor of molding. This we can tell accurately, as we know how many pieces of the given kind will be considered a day's work.

(c) Cost of labor outside of molding, and of coke, sand and other supplies.

(d) The proportionate amount of salaries, insurance, taxes, etc., applicable to this piece of casting. The amount for each of the last items we obtain from the results of the previous year's business in the manner previously indicated.

The process above outlined, if not strictly the best method of ascertaining the cost of manufacture of castings, is at any rate the best that we know of, as our business is conducted. Some may prefer to weigh all the iron, coke and other material used each day, as well as the finished product turned out. This, of course, requires considerable time and care, and so increases, to some extent, the expense of running a foundry. Moreover, there is a liability of a good many inaccuracies in the course of a month or year. The value of our method depends somewhat on the care with which the account of stock is taken at the beginning and end of the year. It would be difficult and expensive to ascertain the exact quantities of the heavier and more valuable portions of the stock on hand in a foundry, such as pig and scrap iron, coke and sand. We therefore make as accurate an estimate of these items as possible, being aided in this by our experience of former years and some rules of measurement which we have established. For example, by measuring a few piles of pig iron the weight of which was known, we have found that about nine cubic feet equal a ton of 2,240 pounds. We feel that our results may be accepted as practically correct.

4. Each different class of foundry needs a different system, for what would be adapted to one shop would not be satisfactory for a shop doing a different class of work. In keeping costs in a foundry it is essential that you do not cover the shop with red tape that will add materially to the cost of the finished product. There are a great number of foundries that either make no pretention to keep the cost, or if they do they do not follow up the subject far enough to know whether there is a profit in a certain line of work or not. It is a simple matter when you wish to bid on a particular job to figure that the molding costs so much, the iron so much per pound or ton, and that a certain price will cover the incidental expenses of coke, sand, etc. In figuring in this way you are totally in the dark as to the cost of incidentals which enter into the cost of every casting. It is a great deal better to know when you figure on a certain job that your expenses are so much per pound and that iron and labor of molding cost so much. You know exactly then what to charge to receive a profit for your labor.

Obituary.

Orson Baker died at Braidwood, Ill., November 22. Deceased, a native of Michigan, was born in 1844 and came to Braidwood in 1873, where he started in the foundry business, which he has followed ever since.

Edward Gschwind, a member of the well-known foundry firm of Boland & Gschwind at New Orleans, La., was accidentally killed November 27 by the explosion of a piston he was heating in order to remove the piston rod.

Elihu Granger, who died December 2 at Scatterwood, S. D., came to Chicago in 1836

and built the first foundry in that city. Mr. Granger was one of the most energetic and progressive citizens the new town had. He engaged in a large number of enterprises, and was elected alderman from the old seventh ward during the 40s and 50s. Later he was superintendent of the department of public works. He lost his property in the fire of 1871 and moved west. He was 94 years old.

Fire Fiend.

A spark from the cupola caused a damage of $700 at the Novelty Foundry in Kansas City, Mo.

Barrett & Son suffered the loss of valuable patterns in a recent fire at their works in Boston, Mass.

The foundry of S. Jarvis Adams & Co., at Pittsburg, Pa., was damaged to the extent of $5,000 by fire on December 3.

The McCarty & Moore Excelsior Iron Works at Leadville, Colo., caught fire from a burning flask and was slightly damaged on December 5th.

The works of the Camden Iron Foundry Company, at Camden, N. J., were damaged by fire to the extent of $12,000 on the 4th inst. Fully insured.

Golley & Finley Iron Works, Lima, O., manufacturers of boilers, engines and drilling tools, suffered from a fire lately, sustaining damage to the extent of $8,000.

The Sycamore Foundry & Machine Co.'s plant, Sycamore, Ill., was recently visited by a fire. Many valuable patterns were destroyed.

The pattern shop of the Bertolette Engine & Machine Co., Norristown, Pa., was destroyed by fire last week, causing a loss in patterns, etc., of $3,000, covered by insurance.

At Bessemer, Ala., the Beggs Foundry & Machine Works; loss $4,000.

The foundry of E. Horton & Son, Windsor Locks, Conn., was damaged by fire to the extent of $20,000 on November 23; partly insured. The fire started from the cupola stack and following the rafters soon spread to the roof, causing great damage to patterns.

Pittsburg and Vicinity.

Business conditions in general, and in iron particularly, are favorable. A strong feeling of encouragement pervades all branches of the iron trade, and the tendency is toward a gradual and healthful expansion of activity. There were many who predicted a boom immediately after election and there are many of these who have been disappointed. There are some who are complaining of the continued depression, but those who take a more hopeful, level-headed view of the situation can see that things are shaping themselves and moving slowly.

Some of the finished lines show slightly lower rates and the indications are that some advances made prematurely will have to be recalled. In all lines a better demand is reported and prospects for a fair amount of work during the coming winter are very good. In nearly every quarter mills and factories are beginning to do more business and are making preparations to handle more.

Several large sized sales of foundry and forge irons have been reported lately. The National Foundry & Pipe Works, of Scottdale, purchased sufficient iron to supply the 26,000-ton cast iron pipe order received from Baltimore. The delivery for this iron extends into June next. One of the Westinghouse interests lately purchased 10,000 tons of foundry iron at the prevailing rate for their own use. Several other large transactions have been closed but names have been withheld. The tone of the market is very hopeful and confident, but there is no scramble for iron except by those who have secured big contracts and are preparing to fill them.

The Robinson-Rae Manufacturing Company, of this city, are engaged in making two of the largest castings ever made by them. Each casting weighs 65,000 pounds and is intended for housings for the new plant of the Keystone Axle Company, near Beaver Falls.

Other foundries are running along smoothly, orders not being extra large, but of sufficient size to keep the plants running fairly full, with increased forces of men. Prices for castings are holding at the old figures, viz.: Chilled rolls, up to 12" diameter, 3¾c per lb.; chilled rolls, over 12" diameter, 3¼c; sand and homogeneous steel rolls and pinions up to 12" diameter, 2¾c; over 12" diameter,

2¾c; V-tooth pinions, additional, 2¼c; housing and rolling mill castings not otherwise specified, 2c; spindles and coupling boxes, 1¾c; squeezer castings, 2c; squeezer pinions and wheels, 2½c; spur and bevel wheels, large, 4c; spur and bevel wheels, small, 3 to 2¼c.

In the coke trade there have not been the gains as anticipated. Production has been gradually falling off and the demand has not been up to expectations. The shipments have not been heavy, the total amount will only reach about 275,000 tons, a decrease of nearly 50,000 tons. Prices, according to circular, are being maintained. Furnace coke is quoted at $2; foundry coke, $2.30, and crushed, $2.35 f. o. b. at ovens. It is understood that lower prices than these can be secured and it is understood that sales of furnace coke have been made at $1.90 and other brands at proportionately lower figures.

The Slaymaker Barry Company, at Connellsville, has prepared plans for the erection of an addition to the works in the shape of an iron foundry for the purpose of making all its castings, which it has hitherto bought in the open market.

Notice.

Advertisements entitled Situations Wanted or Situations Vacant will be inserted in this column One insertion FREE. All others, 25 cents per line.

WANTED—A competent cast iron hollow ware patternmaker. Address box 25, care THE FOUNDRY.

FOR SALE—No. 3 Root blower, used only few months; to be replaced with largest size. Address box 4, care THE FOUNDRY PUBLISHING CO.

WANTED—Situation as superintendent or foreman of foundry. Am able to furnish estimates and produce satisfactory iron mixtures. Fifteen years' experience as superintendent and foreman. Best of references. Address box 43, "THE FOUNDRY."

WANTED—A young man for assistant superintendent of a stove foundry located in the west. State experience and references. Address box 42, "THE FOUNDRY."

FOR SALE—Splendidly equipped Foundry and Machine Shop, well situated, in rapidly growing, rich mining district; doing a good business; in successful operation five years; $2,250 cash, balance on time. Address box 44, care The Foundry.

The machine shops and foundry of the Maltby & Wallace Co. A fine opening for the right kind of a man. For particulars write to J. W. Stipes, Assignee, No. 39 N. Neil St., Champaign, Ill.

Questions and Answers.

J. L., replying to a former question in THE FOUNDRY, relating to the use of bronze for match-plates and patterns, writes as follows:

Bronze does shrink. In an extended practice I have found the shrinkage to run somewhat like the following:

Very hard bronze.....	**0.15**
Common hard bronze.....	0.165
Ornamental or soft bronze.....	0.19
Brass from..... .....0.20 to	0.24

of an inch per foot.

Of course, the above may vary some according to the different mixtures employed, but it is a good general rule to allow 0.18 of an inch to the foot in making patterns for bronze castings. Master patterns should be allowed double shrinkage.

As for a white metal with the minimum of shrinkage the best I know is made from a mixture composed of lead 64¼, zinc 31¼, lead ¾.

Wheeling—Your question is too indefinite to permit of giving an answer without further particulars.

W. J. C. writes:

Will some of the readers of THE FOUNDRY please advance their ideas as to the best way of overcoming segregation in car brasses?

G. W. P. asks:

I wish to make a sand match for a follow board. Kindly state the best composition and how to mix the same.

(For a match that is only to be used a few times, new sand answers the purpose admirably. In fact, the length of life of such a match depends a great deal upon the shape

of the pattern. Where deep projections with but little draft comes in the cope part, its life is short, while with a pattern having no sharp corners we have known such an ordinary sand match to last for several thousands of molds. It is customary with this kind of matches to give them a liberal sprinkling of water every evening when the day's work is done. This dries away during the night and leaves a better surface for the next day and also protects it from cracking. A match of this kind may, of course, be largely strengthened with nails in all parts that are liable to tear, and pieces that do give away may be renewed by moistening the fractured part and building it up again to its former shape. Some foundries cover such matches with a liberal supply of claywash, but this is not to be recommended for the reason that this spoils the exactness of the match and mars the joint line, the very thing we want to keep accurate.

For large work and for matches that are expected to be kept in working order for an indefinite length of time, one of the best sand matches we ever saw was made from a mixture composed of burnt core sand, linseed oil and litharge. The core sand should be all sharp sand, and the reason burnt sand is preferred is because it is finer after having been in contact with the iron. Use a fine sieve, a No. 12 is coarse enough, as fine sand makes the most perfect joint, measure your match-frame, to get the right amount, and don't make this deeper than you have to. If there are any deep lugs or flanges on the pattern, let them cut through the bottom board of the match. This is recommended to save weight, for a sand match is heavy, no matter how light you are able to make it. Add a handful of litharge to half a pail of sand and enough oil to make it have the dampness of ordinary molding sand. When this mixture begins to heat ram it up as you would any other sand match. After the pattern is withdrawn it will require a day to dry, and should for this purpose be placed where it can receive a moderate amount of heat. Great care is required in handling these matches before they become thoroughly dried, as a small shock will change the position of the fragile sharp sand materially. These matches, when dry, are as tough as rubber, and almost indestructible. They also possess the advantage that should any mishap occur to them, it may readily be repaired by using the original mixture and moistening the fractured part with linseed oil.—Ed.)

Lindsey inquires:

Please explain the best methods employed in handling dies. We are making large sheave wheels with an iron die 2¼" by 8" long, and have some trouble to get the die out.

(Perhaps some of our readers engaged in a similar practice may have some way of allaying this difficulty. Personally we should say that the trouble is caused by the die being out of true. Using a die over and over again induces it alternately to expand and contract, and we would suppose that it should at least return to its former shape. We were convinced recently that such is not the case, however. A piece of steel was turned up true and then tempered, and found to be out, the difficulty being remedied by regrinding. Of course, it may not be out much, but it takes but very little to hold a die under such circumstances.

Some foundries use various oils as a protection, but this is bad practice, as any oil creates gas. This gas agitates the metal until it is burned away, and produces a dirty casting. One of the most successful ways we have observed in this line is to dip the dies in a rather thick plumbago wash and thoroughly drying it in the core oven. Some molasses should be added to this wash in order to harden the coat applied to the die, otherwise it is liable to crumble away as dust after drying. This matter of applying a coat brings us to another phase of the question; the diameter of the hole is increased. By carefully dipping the die and not attempting to paint it with a brush, the most uniform covering will be applied, but it is a covering of a certain thickness and takes up room just the same, and we call attention to it at this early stage to avoid the creation of another foundry "mystery."—Ed.)

F. & Co. would like to know something about a mixture for brass that will prove perfectly acid proof, or nearly so.

P. writes:

I have trouble to keep my cupola from

burning out at the melting point. Can you instruct me how to daub, and what kind of material to use to make it stand?

(There are at present several preparations on the market for this purpose. Gannister, employed by a great many blast furnaces, is also becoming a favorite. The trouble we have to contend with in the home-made material is, in the first place, that we use too much. When the heat strikes it and generates a great amount of steam in the wet mass, it scales off and falls among the charges before it serves any purpose whatever. In the second place, we use too much clay in our daubing mixtures. Clay should be used like flour is in core sand, simply as a binder. It contains nothing that will withstand heat and, wherever exposed, only melts away and adds to the accumulation of slag. What does contain the fire-proof properties is what we know as sharp sand, but even this can not protect a poor quality of fire-brick. When the lining of a cupola burns away, we are, to use Cleveland's words, confronted with a condition and not a theory. The condition is like this: Either do we have too much heat in the cupola, that is more than is necessary, or else we have our cupola lined with such inferior stuff as will not permit of keeping up the required temperature. There is no middle road here, it must be either the one or the other.—Ed.)

A correspondent from Heidelberg, Germany, asks:

Can the refuse found around furnaces and cupolas known as slag be put to any practical use or be turned into anything that would pay for handling it?

Answer: In some places it is disposed of to advantage for road-making, though most foundries would consider themselves fortunate in getting it removed gratis. Cupolas make but a small amount of actual slag, and this is so mixed with dirt and general refuse found around a cupola, that it is doubtful if it would pay to sort it over.

With blast furnaces this question assumes altogether another phase and plants have in many cases been established close to such for the express purpose of utilizing the very material that had formerly been thrown away.

The greatest practical use that has been found for the slag from furnaces has been in the manufacture of mineral wool, or silicate cotton, as it is often named.

The wool itself serves a variety of useful purposes, as a non-conducting covering against heat and cold alike, for steam pipes and cold storage walls, as a sound deadener in floors of buildings, and as a means of fireproofing. It is a soft and wooly substance, consisting of a mass of very fine mineral fibres interlacing one another in every direction, and thus forming an endless number of minute air cells.

The furnace slag is melted in a cupola, and as it trickles out at the tap hole it meets a high pressure steam jet, which atomizes the woolen material, blowing it in fleecy clouds throughout the room.

Some cupolas turn out as much as a thousand pounds of wool per hour. The whole process furnishes an admirable and interesting illustration of the utilization of a formerly wasted product.

E. E. D. asks how to harden iron in the ladle.

What is meant here is undoubtedly how to harden a small portion of iron without affecting part of the heat. In other words, how to harden soft iron where there is not enough work at hand to pay for running a heat, or part of a heat, of a hard iron mixture.

If the work is heavy, the iron may, if melted hot, be cooled down with hard iron scrap, such as old plow points or anything else that approximates white iron, the whiter or harder the better in this case. Steel scrap will tend to produce the same result, the object sought being to reduce the silicon and graphitic carbon. Any material or process accomplishing this will harden iron.

The greatest obstacle in the way of hardening iron after it leaves the cupola and is in the ladle is to have it of a sufficient high temperature to permit it of absorbing the elements introduced to harden it and still retain enough fluidity to fill the mold. It will be observed that for light work this method is out of the question.

It may not be amiss to state here that cast iron can, to a certain degree, be hardened after casting. A recipe for this purpose says: Heat the part to be hardened and ap-

ply prussiate of potash, again heat and quench in water.

It is urged that a repetition of the above process one or more times is often found to be advantageous.

Among the Foundries.

Wm. Conts is building a foundry at Shenandoah, Ia

The Belle City Malleable Iron Co., Racine, Wis., have increased their capital stock from $40,000 to $75,000.

The plant of the Moore Manufacturing & Foundry Co., of Milwaukee, has been sold to T. J. Neacy.

The Howard Harrison Co., of Bessemer, Ala., has secured a contract for supplying the city of St. Louis with 10,000 tons of iron pipe.

The Gibson Iron Works, of Gibson City, Iowa, has been leased to Messrs. C. W. Story and C. M. Converse, of Chicago, who will put the works into active operation.

The Wiard Foundry Co., of Brooklyn, N. Y., has been incorporated with $10,000 capital. The directors are: Matthew Wiard and William N. Calder, of New York, and William J. Serrell, of Bayonne, N. J.

The Smedley Steam Pump & Manufacturing Co. has been incorporated at Dubuque, Ia., with a capital stock of $60,000. The directors are Frank Bell, Fred Bell, Wm. Lawther, Edwin Smedley, Louis H. Brede, George Minges and George W. Keisel.

The Estey Manufacturing Co., at Laconia, N. H., will add a brass foundry to their plant.

The J. W. Reedy Elevator Manufacturing Co., of Chicago, will enlarge their foundry.

The American Brass & Manufacturing Co., St. Louis, will rebuild at once its brass foundry destroyed by fire some time ago.

The South Pittsburg Pipe Works, of South Pittsburg, Tenn., has secured an order for several miles of cast-iron water pipe for use in the city of Honolulu. The success of this company in picking up occasional foreign orders for pipe, in competition with Belgium and English foundries, shows its advantages for turning out its product at the lowest possible cost. The success of this and other southern iron companies in reaching for foreign markets points to the great future before the iron interests of the south in the development of foreign trade.

Chadwick Bros. have erected a new foundry at Randolph, Vt.

McClave, Brooks & Co. are building a new foundry at Scranton, Pa.

The Somerset Stove Foundry Co., of Somerset, Mass., is to rebuild its plant.

F. D. Munger has completed a new foundry at Angola, Ind.

The Niagara Falls Metal Works are constructing an iron foundry at Niagara Falls, Ont.

The Kahn Stove Co., of Hamilton, will soon build a large addition to their plant, which will greatly increase its capacity.

The American Brass Manufacturing Co., of St. Louis, Mo., is to build a large new foundry.

Some graphite deposits have been found in Portage county, Wis., and are now being developed by N. A. Weeks, of Chicago.

The first of the three artistic bronze doors for the main entrance of the new Congressional Library in Washington has been completed at the works of John Williams, New York city.

The East Birmingham Foundry & Machine Co., of Birmingham, Ala., is making preparations to increase the capacity of its plant in all departments.

A license to incorporate has been issued to the United States Malleable Iron & Steel Co., Chicago; capital stock, $100,000. Incorporators, Henry H. Blake, Frank J. Kilcrane and Emanuel Friedlander.

The New England Steel Co., Camden, N. J., has been organized with a capital of $100,000 to manufacture iron castings. Incorporators, Henry T. Kent, George W. Ring and others.

The Sessions Foundry have recently erected in their foundry a new 25-ton electric traveling crane, built by the Morgan Engineering Works, of Alliance, O. This makes two cranes of this same type and size. The span is 60 feet and traverse 220 feet. They are also erecting two 6-ton hydraulic jib cranes, built by R. D. Wood & Co., Philadelphia, Pa. These give them very much increased capacity for making heavy work.

The Norfolk Iron Works at Norfolk, Va., is making an extensive addition to its plant.

The Blacklock Foundry Co., of South Pittsburg, Tenn., is increasing its plant.

The Bridgeford Foundry Co., of Louisville, Ky., will erect a new plant.

The Woods Foundry Co. will rebuild their foundry at Troy, N. Y.

H. M. Bird is building a foundry at Cambridge, Mass.

Cooper Bros. have moved into their new foundry at Cortland, N. Y.

O'Rorke & Co., of Peoria, Ill., will enlarge their foundry.

The Manchester (O.) Stove Foundry has been sold to a party of Manchester business men and D. W. Jones, of Columbus, O.

The Laidlaw-Dunn-Gordon Co., of Tweedvale, O., is preparing specifications for a new foundry building.

The Eagle Brass Works, of Chattanooga, Tenn., will rebuild its foundry, which has been damaged to the extent of $4,500 by fire.

The Marvel City Machine & Foundry Co., at Besemer, Ala., will rebuild its burned works and put in equipment of new machinery.

At St. Louis Thomas Johnson, Frank C. Riddle and George M. Block have incorporated the Twin Burner Vapor Stove Co., with a capital stock of $15,000.

The Bridgeport (Ala.) Stove Works have just completed an addition to their plant, enabling them to accommodate twenty hands additional.

The business of the Glennon Iron Foundry has been combined with that of the brass works of P. J. Conroy & Co., Philadephia, under the style of the P. J. Conroy & Co. Brass & Iron Works.

At Alton, Ill., the Duncan Foundry Co. has begun the construction of an addition to its new shop, and the improvement, when complete, will add materially to the capacity of this busy concern.

The American Foundry Co.'s plant at Edison, Wash., has been turned over to the Griffin Wheel Co., of Chicago, which will at once enlarge the institution and begin the manufacture of car wheels on a much larger scale.

The Holliday Stove Foundry at Middlesboro, Ky., is extending its molding room.

The shrinkage of aluminum is a little more than that of brass, being 17-64 of an inch to the foot.

Robert Wetherill & Company, of Chester, Pa., have prepared plans for the erection of a modern foundry with every improved facility for handling large work promptly and economically.

The Carroll Foundry Co., of Houghton, Mich., has purchased the rolling mill property at that place, having a lake frontage of 425 feet, and will erect thereon a complete foundry plant.

The Simonds Manufacturing Company, of New York city, has incorporated to conduct a general foundry business and manufacture stoves, ranges and furnaces. Capital, $3,000. Directors—Stephen Birch, of Mahwan, N. J.; John J. Moorhead and Joseph Moorhead, of New York city.

Shop Ventilation.

So far as inclination goes, I feel rather minded to vote the machinist the head and front mechanic of the world, which probably comes mainly from early associations. That is so far as relates to a good machinist just in line with his vocation. But when it comes to other things quite intimately connected with shop operations, there is not so much to be said in his favor. This comes up from a recent visit to an eminent machine manufacturing establishment, situated in one of the eastern states. Not one of those establishments with a few dollars behind it, but one backed up with a million or thereabouts to hold it together. An establishment with no end to the machinists' talent in the way of ownership and management.

The tools to work with are the best, office well appointed, but when it comes to ventilation of work room, it was about the worst that could be conceived. Place the best machinist in the land in such ventilated shops, force him to breathe cast-iron dust a quarter of an inch thick, and his inherent and acquired ability is prostrated. You can't expect and you can't get good work from him. If you are called on to get out good work, base your ability to do so as much on the

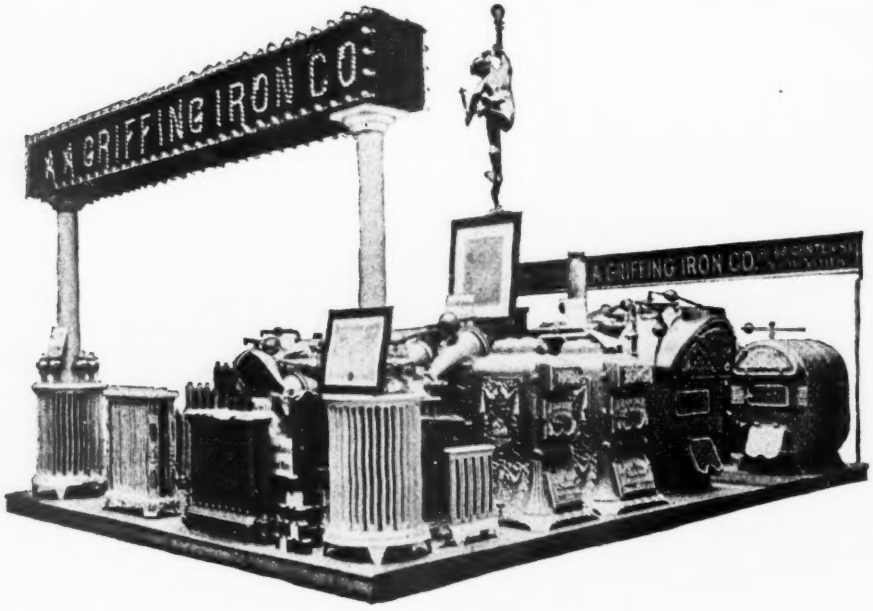
ventilation of your shop as you do on the tools your workmen have to work with.

If I had shops in which natural ventilation was not practicable, I would put in a little fan and blow or suck good air right up through every story of the shop, in the full belief that I was getting the best possible results for the coal burned to do the work. You have no right to expect good work from men furnished with poor appliances, and the poorest of all appliances is poor air. When you build your shop, build it with a good square idea of getting good air into it and bad air out of it, and brag about it as much as you do your engine and tools. It will bear it.—F. F. Hemenway, in "The Tradesman."

(What is said above in the interest of the machinist, ought with a double force be put before the owners and managers of foundry plants. We wonder, however, how the machinist, in addition to his solid food of cast-iron dust, would like to inhale about four cubic yards of smoke, generated by a native American core, with the usual allotment of steam, dirt and heat thrown in to fill up the cracks. We have never seen a machinist with enough cast iron in his system to exhaust and incapacitate him from the further performance of his duties. We have seen molders and other foundry help in such a condition that they were not responsible for the half-suppressed curses they uttered. Not only humanity, but the fact that men increase their capacity to produce in a direct ratio to their surroundings, should cause a more serious consideration of this problem.—Ed.)

Exhibit of A. A. Griffing Iron Co.

We take pleasure in presenting to our readers a view of the exhibit of A. A. Griffing Iron Co., at the American Institute fair recently held at Madison Square Garden, New York. As will be seen by examining the accompanying illustration, the character of the



exhibit, however, was such that it was impossible to move very far without being impressed with its presence. It was resplendent with 2,000 electric lights overhead and 1,000 more were distributed through it. It occupied eight spaces, and being centrally located under a large electric chandelier was without question one of the most effective displays at the exhibition. The Bundy heater, with its sectional tubular construction, was examined by the public for its various good points, and the Bundy La Villa heaters attracted much attention for their handsome design and perfect finish. Prominent among the goods displayed was a full line of Bundy, Renaissance, Elite, Empire, Columbia and Princess

radiators, besides various styles of indirect radiators. A large line of Bundy steam specialties was shown, among them being the Bundy steam traps, steam and oil separators and feed water heaters. Samples of the Bundy cement felting insulation for covering boilers or piping were also shown, and an elaborate display was made of bronze powder, bronzing liquid, enamels, etc. A central figure consisting of a large statue of Mercury, holding high in the air a glass globe surrounding a powerful arc light, the globe having on it the company's trade mark "Bundy," added materially to the interest and attractiveness of the display.

The Rochester Co-operative Foundry is one of the few concerns believing in actual reciprocity with its employes. In distributing turkeys and oysters among its men Thanksgiving day it followed its annual custom, and in doing so gave them something real to be thankful for, an example we believe others might imitate with profit.

Avoid Makeshifts.

An officer of the first company that employed me as foreman suggested that I employ an extra laborer to keep things in orderly shape about the foundry. I answered that it would cost between $300 and $400 a year. "No matter," he answered, "a tidy, well-kept factory commends the owners to the business world; it is right on general principles, and it pays."

Judging from the appearance about foundries generally there is a great diversity of opinion on this subject. A foundry is a difficult thing to keep clean and in good ship shape, and the character of the work done has much to do with the question of the profitableness of the undertaking, if carried to the extreme. However, there can be no doubt of the desirability of cleanliness and order, and every foreman should, under all circumstances, be vigilant in endeavor to that end.

The practice in some foundries of making cheap temporary facilities has much to do with littering the premises. A makeshift is more often in the end an extravagance than a means of economy.

For instance, you want a dozen flasks of certain dimensions in order to the speedy turning out of a job in hand. You say: "I may never have any more of these to make—I'll just nail up some flasks of one-inch boards—they'll be the cheapest thing—I probably shan't want to use them again." But you will use them again; you will, in all probability use those flasks from time to time, till they shall be beyond possibility of further use. That won't be very long, of course, for their clap-trap character precludes longevity. But, meantime, you will have lost a good deal of money by their use. They soon become slimpsy and awry. They are so fragile as to permit easy distortion of the mold.

The cope sand frequently falls out, the clamps hold them down in one place and cock them up in another; the iron runs out at the joint, and general demoralization attends upon their career to the end.

The molder who is compelled to employ inadequate facilities may be a good workman, and yet his product may indicate the reverse.

I have seen good molders losing their work become so bewildered as to incapacitate them for judging as to the cause, simply because the facilities supplied them were so defective as to necessitate a departure from approved practice.

"Whatever is worth doing at all is worth doing well," is a good axiom in foundry practice.

Patterns are sometimes run for years in an unfinished state, thus adding to cost of molding and entailing frequent loss of the castings.

In an attempt to save a little money in cost of pattern, we sink a good deal in cost of molding as a direct consequence. And the fact should never be forgotten that excessive cost of molding is always to be multiplied by the number of times the pattern is molded. As I have said before (and it will bear saying a great many times), all permanent patterns should be finished to the highest degree of perfection. And, to this end, the foreman should make every molder in the shop his friend, encouraging them to complain of any defect, in order to their more speedy correction. No foreman of a large foundry can possibly keep up with the condition of all the patterns without the cooperation of his workmen.

Yet, very often the foreman rudely rebuffs the complaining molder. And, with some foremen, this acerbity of disposition loses to them entirely the aid of the workmen in this matter.

While a journeyman I have often seen molders killing time with unfit patterns, not daring to call the foreman's attention to their defects. Here is a colloquy that molders have often heard.

Molder—Mr. Foreman, this pattern has no draught; it won't draw. I can't get it out of the sand without breaking the mold.

Mr. Foreman—That pattern has been run for four years and you're the first man that ever kicked at it.

The foreman struts along down the gangway like a great man, never suspecting himself of being a fool, while the molders in the vicinity grin and gibe at the man who knew no better than to complain of a defective pattern.

They all furthermore take warning from their shopmate's fate to keep their own mouths shut on a like occasion, and the employer pays the cost.

The obvious duty of the foreman was, of course, to make a thorough examination of the pattern at the earliest possible moment, and, finding (as he probably would) a defect, have it corrected at once, and then to thank the molder for calling his attention to it.

A persistent kicker may often prove to be the most valuable man in the foundry. Of course, it much depends on the direction of his kick. But many a foundry would die of the dry rot along with its decaying flasks if an occasional molder did not rise in his wrath and demand either something fit to do with or his "time"—"whichever you like, sir."

Of course, he gets his "time," but the foreman takes the lesson just the same, at least to some extent, and somewhat of improvement is made in the facilities for the remaining workmen. All great causes have their martyrs, and that of improvement in foundry furnishings is no exception to the rule. A very strange human characteristic is that which leads us to advise so differently from what we practice. For instance, in advertising our goods for sale we say, "Do not use inferior machinery—buy the best. In these days of low prices and close competition the man who strives to get along with cheap makeshifts must inevitably fail, while he who provides himself with such perfect machines as we are offering will gather in the shekels as a reward for his superior wisdom." And then we go about hunting a chance to buy a second-hand wheelbarrow. You and I don't do this, but the other fellow does!

Seriously, I believe that the greater the first cost of facilities, wisely expended, the larger will be the profit in iron founding.—E. H. Putnam in The Tradesman.

A NEW CATALOGUE, descriptive of their pattern letters and pattern makers' supplies, has just been issued by H. W. Knight & Son, of Seneca Falls, N. Y. Every foundryman who is desirous of having his work properly lettered should see that the man who makes his patterns has that catalogue in his possession. Much of the trouble now caused by the use of poor patterns might be avoided by the employment of a first class article.

What Becomes of Iron.

Those of us who are engaged in foundry practice are apt to consider the cupola and molding room as the chief consumer of iron. Just to show an example of what becomes of some of the millions of tons of iron ore brought to the surface yearly, we will mention that a building now being erected in New York will consume in its construction no less than nine thousand (9,000) tons of steel work to form its framework. This is as much as would be required to lay 100 miles of track with 50-pound rails, and shows that if the foundries are not doing much, and railroad building almost at a standstill, there is still to be found a market for an enormous amount of iron.

The Brass Founders' Supply Co., of Newark, N. J., report a continued increase of demand from brass foundries throughout the flask has exceeded all expectations; it is proving itself a winner.

Mulhall says that "in twenty years ending in 1889 the railroads have absorbed 43,500,000 tons of steel, or almost half the total product."